



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James F. Pitzen <i>et al.</i>	Examiner:	
Patent No.:	5,792,573	Group Art Unit:	1714
Assignee:	Linvatec Corporation	Application No.	09/954,526
Filed:	July 24, 1996	Docket No.:	54525.000055
Issued:	August 11, 1998	Parent Application No.	09/637,339
Title:	RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO ORTHOPEDIC DEVICE		

**PETITION UNDER 37 C.F.R. §1.47(b) FOR ACCEPTANCE OF
THE REISSUE APPLICATION WITHOUT PARTICIPATION
OF ONE OR MORE INVENTOR**

Assistant Commissioner for Patents
BOX REISSUE
Washington, D.C. 20231

Sir:

Petitioner and assignee of the above-captioned patent and Reissue Application, Linvatec Corporation, hereby petitions the Commissioner pursuant to 37 C.F.R. §1.47(b) to accept the Reissue Declarations and accompanying papers ("the Reissue Application") without the inventors' signatures. In support of this petition, and in accordance with the Manual of Patent Examining Procedure (MPEP) §409.03(b), petitioner submits the following statements and supporting documents:

A. An executed copy of the Reissue Declaration filed with the application papers on August 11, 2000, and an executed copy of the Reissue Declaration filed with the Continuation Reissue Application on March 5, 2001 ("collectively referred to herein as "the Reissue Declarations"). The application papers filed with the Reissue Declarations on March 5, 2001 also are attached hereto as Appendix A. The Reissue Declarations are signed by Patrick A. Doody, Registration No. 35,022, who is authorized to sign on behalf of the assignee, Linvatec Corporation;

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B. As noted in the Declaration of Patrick A. Doody, which is attached hereto as Appendix B, and as discussed in more detail in Section E below, Linvatec Corporation is the assignee in and to the above-captioned United States Patent No. 5,792,573, in the name of Pitzen, *et al.* (hereinafter, "the Pitzen patent"). In compliance with 37 C.F.R. §1.64, the attached Reissue Declarations state that Linvatec Corporation's relationship to the inventors is that of assignee;

C. In accordance with MPEP §409.03(d), petitioner attaches hereto as Appendix B, the Declaration of Patrick A. Doody, setting forth the facts and providing documents evidencing each of the inventor's refusals to execute the Reissue Declarations;

D. In accordance with MPEP §409.03(e), the last known address of each inventor is set forth on the first page of the Reissue Declarations, and is reproduced below:

James F. Pitzen,
436 Oday Street South,
Maplewood, Minnesota 55119-5540;

Jeffrey D. Smith,
19340 North Newgate Avenue,
Marine on Saint Croix, Minnesota 55047; and

Charles E. Alexson,
12651 W Twin Lake Road,
Hayward, Wisconsin 54843-5314;

E. In accordance with MPEP §409.03(f), petitioner submits the following information and evidence establishing that Linvatec Corporation is the assignee of the Pitzen patent, and any reissue applications filed thereon. The originally named inventors of the Pitzen patent, Mr. James F. Pitzen, Mr. Jeffrey D. Smith, and Mr. Charles E. Alexson assigned their entire right, title, and interest in and to the Pitzen patent, and any reissues thereof, to 3M by virtue of an Assignment recorded at Reel 7042, Frame 559-561, a copy of which is attached hereto as Appendix C. 3M subsequently assigned its right, title, and interest in and to the Pitzen patent, including any reissues thereof, to Linvatec Corporation by virtue of an assignment executed by


Gary Griswold, Staff Vice President of 3M, on September 19, 2000, a copy of which is attached hereto as Appendix D; and

F. In accordance with MPEP §409.03(g), petitioner will suffer irreparable harm if the Commissioner does not permit it to file the above-captioned Reissue Application without participation by the inventors. The Reissue Application was filed on August 11, 2000, the two (2) year anniversary date of the issue date of the Pitzen patent. This filing date is needed to preserve petitioner's rights.

On behalf of petitioner, Linvatec Corporation,

Respectfully submitted,

1/4/01
Date



Patrick A. Doody
Registration No. 35,022

HUNTON & WILLIAMS
1900 K. St., N.W.
Washington, D.C. 20006
(202) 955-1906

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REISSUE PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James F. Pitzen et al. Examiner:
Patent No.: 5,792,573 Group Art Unit: 1111
Assignee: Linvatec Corporation
Filed: July 24, 1996 Docket No.: 5809.263-US-RE
Title: RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO
ORTHOPEDIC DEVICE

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL488196274US

Date of Deposit: 11 August 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By:

Name: Linda McCormick

REISSUE DECLARATION OF JAMES F. PITZEN,
JEFFREY D. SMITH, AND CHARLES E. ALEXSON

We, James F. Pitzen, Jeffrey D. Smith, and Charles E. Alexson declare as follows:

1. We are citizens of the United States of America, residing at:

James F. Pitzen,
436 Oday Street South,
Maplewood, Minnesota 55119-5540;

Jeffrey D. Smith,
19340 North Newgate Avenue,
Marine on Saint Croix, Minnesota 55047; and

Charles E. Alexson,
12651 W Twin Lake Road,
Hayward, Wisconsin 54843-5314, respectively.

2. We are the original, first and joint inventors of the invention described in Letters Patent No. 5,792,573, granted August 11, 1998, described and claimed in the accompanying application for which we solicit a reissue patent.

3. We have reviewed and understand the contents of the specification and claims of this application, including reissue claims 13-35 added by preliminary amendment and filed along with this declaration.

4. We believe the above-identified patent is partially inoperative by reason of claiming less than we had the right to claim in the patent. Specifically, we believe that we are entitled to generic claims that more adequately cover the subject matter of our invention as we understand and contemplated when originally filing the above-mentioned patent. This subject matter is set forth in reissue claims 13-35 added as part of this reissue application.

5. It was an error to fail to include in the above-identified patent, apparatus claims commensurate in scope with those set forth in reissue claims 13-35.

6. Specifically, it was an error, for example, not to include a claim having the scope of that provided in new claim 13. In claim 13, the language describing the resealable attachment structure has been modified to more adequately cover the subject matter of our invention. It was an error not to include such a claim, with the reworded elements as provided below.

Claim 1	Claim 13
1. A rechargeable battery adapted to be repeatably and releaseably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and a blocking member movable between latched and release positions;	13. A rechargeable battery adapted to be repeatably and releasably attached to a drive assembly, the drive assembly having battery terminals and a battery receiving portion;
said battery comprising: an autoclavable battery housing having top and bottom portions, at least one cell within the battery housing and a pair of battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly,	said battery comprising: a battery housing having top and bottom portions, at least one cell within the battery housing and battery contacts adjacent the housing and situated to engage the battery terminals of the drive assembly;
releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion,	one of the drive assembly and the battery having a pair of tracks defining flanges; and the other of the drive assembly and the battery having grooves configured to receive the flanges of the tracks; wherein the battery may be repeatably and releasably attached to the drive assembly by sliding the battery into and out of engagement with the drive assembly.
said releasable attachment means comprising:	
(a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and	
(b) a slot for receiving the blocking member when the blocking member is in the latched position.	

7. It was also an error to not include a claim having the scope of that provided in new claim 21. Comparing to original claim 1, claim 21 has less rewording than does claim 13 to indicate, broadly, the elements of the Applicants' inventive, rechargeable battery adapted to be repeatably and releasably attached to a drive assembly. Specifically, for example, it was an error to not include a claim directed to a rechargeable battery:

- (a) attached to a drive assembly without the limitation that the drive assembly be "an orthopedic" drive assembly;
- (b) attached to a drive assembly without the limitation that the drive assembly include "a blocking member movable between latched and release positions";
- (c) attached to a drive assembly without the limitation that the drive assembly include "a pair of" battery terminals;
- (d) without the limitation that the rechargeable battery include "a pair of" battery contacts;
- (e) without the limitation that the rechargeable battery be "autoclavable"; and
- (f) comprising a resealable attachment means without the limitation that the resealable attachment means comprise "a slot for receiving the blocking member when the blocking member is in the latched position."

To identify changes made in new claim 21 with respect to original claim 1, set forth below is new claim 21 with the underlined language indicating additions to the text of original claim 1 and language in bolded brackets indicating language that has been deleted from original claim 1.

It was an error not to include a claim having the changes indicated in new claim 21.

21. A rechargeable battery adapted to be repeatably and releasably attached to a[n **orthopedic**] drive assembly, the [orthopedic] drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, and [a pair of] battery terminals[, and a **blocking member movable between latched and release positions**];

said battery comprising:

a[n **autoclavable**] battery housing having top and bottom portions, at least one cell within the battery housing and [a pair of] battery

contacts adjacent the top portion of the housing and situated to engage the battery terminals of the [orthopedic] drive assembly, and
releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion[,
said releasable attachment means comprising:
(a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
(b) a slot for receiving the blocking member when the blocking member is in the latched position].

8. It was also an error to not include a claim having the scope of that provided in new claim 29. Comparing to original claim 1, claim 29 has less rewording than does claim 13 or 21 to indicate, broadly, the elements of the Applicants' inventive, rechargeable battery adapted to be repeatably and releasably attached to an orthopedic drive assembly. Specifically, for example, it was an error to not include a claim directed to a rechargeable battery:

- (a) without the limitation that the rechargeable battery be "autoclavable";
- (b) attached to a drive assembly without the limitation that the drive assembly include "a blocking member movable between latched and release positions";
- (c) attached to a drive assembly without the limitation that the drive assembly include "a pair of" battery terminals;
- (d) without the limitation that the rechargeable battery include "a pair of" battery contacts; and
- (e) comprising a resealable attachment means without the limitation that the resealable attachment means comprise "a slot for receiving the blocking member when the blocking member is in the latched position."

To identify changes made in new claim 29 with respect to original claim 1, set forth below is new claim 29 with the underlined language indicating additions to the text of original claim 1

and language in bolded brackets indicating language that has been deleted from original claim 1.

It was an error not to include a claim having the changes indicated in new claim 29.

29. A rechargeable battery adapted to be repeatably and releaseably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, and **[a pair of]** battery terminals[, **and a blocking member movable between latched and release positions**];

said battery comprising:

a**[n autoclavable]** battery housing having top and bottom portions, at least one cell within the battery housing and **[a pair of]** battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly, and releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion[,

said releasable attachment means comprising:

- (a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and**
- (b) a slot for receiving the blocking member when the blocking member is in the latched position].**

9. All errors being corrected in this reissue application arose without any deceptive intention on the part of the applicants.

10. We acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 C.F.R. § 1.56(a).

11. We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

12. I authorize Merchant & Gould P.C. to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

See below
James F. Pitzen

Date: _____

See below
Jeffrey D. Smith

Date: _____

See below
Charles E. Alexson

Date: _____

On behalf of Linvate Corporation, the assignee of the above-identified Patent, who, pursuant to 37 C.F.R. §1.47(b) is signing on behalf of the above-named inventor:



PATRICK A. DOHERTY
Reg. No. 357022

JANUARY 4, 2001



REISSUE PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James F. Pitzen et al. Examiner:
Patent No.: 5,792,573 Group Art Unit: 1111
Assignee: Linvatec Corporation
Filed: July 24, 1996 Docket No.: 54525.000055
Title: RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO
ORTHOPEDIC DEVICE

**REISSUE DECLARATION OF JAMES F. PITZEN,
JEFFREY D. SMITH, AND CHARLES E. ALEXSON**

We, James F. Pitzen, Jeffrey D. Smith, and Charles E. Alexson declare as follows:

1. We are citizens of the United States of America, residing at:

James F. Pitzen,
436 Oday Street South,
Maplewood, Minnesota 55119-5540;

Jeffrey D. Smith,
19340 North Newgate Avenue,
Marine on Saint Croix, Minnesota 55047; and

Charles E. Alexson,
12651 W Twin Lake Road,
Hayward, Wisconsin 54843-5314, respectively.

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2. We are the original, first and joint inventors of the invention described in Letters Patent No. 5,792,573, granted August 11, 1998, described and claimed in the accompanying application for which we solicit a reissue patent.

3. We have reviewed and understand the contents of the specification and claims of this application, including reissue claims 13-35 added by preliminary amendment and filed along with this declaration.

4. We believe the above-identified patent is partially inoperative by reason of claiming less than we had the right to claim in the patent. Specifically, we believe that we are entitled to claims that are not limited to application to orthopedic devices, and that more adequately cover the subject matter of our invention as we understand and contemplated when originally filing the above-mentioned patent. In fact, during prosecution of the parent application serial No. 08/258,338, that ultimately resulted in the issuance of U.S. Patent No. 5,792,573 (the patent referred to herein), the Examiner issued a restriction requirement and stated that the subject matter in the claims ultimately issued in U.S. Patent No. 5,792,573 could be utilized in other power tools, such as power screwdriver. This subject matter, which does not limit the battery's utility to an orthopedic device, is set forth in reissue claims 13-35 added as part of this reissue application.

5. It was an error to fail to include in the above-identified patent, claims commensurate in scope with those set forth in reissue claims 13-35.

6. Specifically, it was an error, for example, not to include a claim having the scope of that provided in new claim 13. In claim 13, the language describing the releasable attachment structure has been modified to more adequately cover the subject matter of our invention. It was an error not to include such a claim, with the reworded elements as provided below.

Claim 1	Claim 13
1. A rechargeable battery adapted to be repeatably and releaseably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and a blocking member movable between latched and release positions;	13. A rechargeable battery adapted to be repeatably and releaseably attached to a drive assembly, the drive assembly having battery terminals and a battery receiving portion;
said battery comprising: an autoclavable battery housing having top and bottom portions, at least one cell within the battery housing and a pair of battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly,	said battery comprising: a battery housing having top and bottom portions, at least one cell within the battery housing and battery contacts adjacent the housing and situated to engage the battery terminals of the drive assembly;
releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion,	one of the drive assembly and the battery having a pair of tracks defining flanges; and the other of the drive assembly and the battery having grooves configured to receive the flanges of the tracks; wherein the battery may be repeatably and releaseably attached to the drive assembly by sliding the battery into and out of engagement with the drive assembly.
said releasable attachment means comprising:	
(a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and	
(b) a slot for receiving the blocking member when the blocking member is in the latched position.	

7. It was also an error to not include a claim having the scope of that provided in new claim 21. Comparing to original claim 1, claim 21 has less rewording than does claim 13 to

indicate, broadly, the elements of the Applicants' inventive, rechargeable battery adapted to be repeatably and releasably attached to a drive assembly. Specifically, for example, it was an error to not include a claim directed to a rechargeable battery:

- (a) attached to a drive assembly without reciting that the drive assembly be "an orthopedic" drive assembly;
- (b) attached to a drive assembly without reciting that the drive assembly includes "a blocking member movable between latched and release positions";
- (c) attached to a drive assembly without reciting that the drive assembly include "a pair of" battery terminals;
- (d) without reciting that the rechargeable battery include "a pair of" battery contacts;
- (e) without reciting that the rechargeable battery be "autoclavable"; and
- (f) comprising a releasable attachment means without reciting that the releasable attachment means comprise "a slot for receiving the blocking member when the blocking member is in the latched position."

To identify changes made in new claim 21 with respect to original claim 1, set forth below is new claim 21 with the underlined language indicating additions to the text of original claim 1 and language in bolded brackets indicating language that has been deleted from original claim

1. It was an error not to include a claim having the changes indicated in new claim 21.

21. A rechargeable battery adapted to be repeatably and releasably attached to a[n orthopedic] drive assembly, the [orthopedic] drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, and [a pair of] battery terminals[, **and a blocking member movable between latched and release positions**];

said battery comprising:

a[n autoclavable] battery housing having top and bottom portions, at least one cell within the battery housing and [a pair of] battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the [orthopedic] drive assembly, and

releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion[, **said releasable attachment means comprising:**

- (a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
- (b) a slot for receiving the blocking member when the blocking member is in the latched position].

8. It was also an error to not include a claim having the scope of that provided in new claim 29. Comparing to original claim 1, claim 29 has less rewording than does claim 13 or 21 to indicate, broadly, the elements of the Applicants' inventive, rechargeable battery. Specifically, for example, it was an error to not include a claim directed to a rechargeable battery:

- (a) without reciting that the rechargeable battery be "autoclavable";
- (b) attached to a drive assembly without reciting that the drive assembly include "a blocking member movable between latched and release positions";
- (c) attached to a drive assembly without reciting that the drive assembly include "a pair of" battery terminals;
- (d) without reciting that the rechargeable battery include "a pair of" battery contacts; and
- (e) comprising a releasable attachment means without reciting that the releasable attachment means comprise "a slot for receiving the blocking member when the blocking member is in the latched position."

To identify changes made in new claim 29 with respect to original claim 1, set forth below is new claim 29 with the underlined language indicating additions to the text of original claim 1 and language in bolded brackets indicating language that has been deleted from original claim

1. It was an error not to include a claim having the changes indicated in new claim 29.

29. A rechargeable battery adapted to be repeatably and releaseably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, and [a pair of] battery terminals[, and a blocking member movable between latched and release positions];

said battery comprising:

a[n autoclavable] battery housing having top and bottom portions, at least one cell within the battery housing and [a pair of]

battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly, and
releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion[,
said releasable attachment means comprising:
(a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
(b) a slot for receiving the blocking member when the blocking member is in the latched position].

9. All errors being corrected in this reissue application arose without any deceptive intention on the part of the applicants.

10. We acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 C.F.R. § 1.56(a).

11. We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

12. I authorize Hunton & Williams, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

See below
James F. Pitzen

Date: _____

See below
Jeffrey D. Smith

Date: _____

See below
Charles E. Alexson

Date: _____

On behalf of Lioratex Corporation, the assignee of the above-identified patent, who, pursuant to 37 C.F.R. §1.47(b) is signing on behalf of the above-named inventors:



Patrick A. Doody
Reg. No. 35,022

JANUARY 4, 2001

United States Patent [19]

Pitzen et al.

[54] RECHARGEABLE BATTERY ADAPTED TO
BE ATTACHED TO ORTHOPEDIC DEVICE

[76] Inventors: James F. Pitzen; Jeffrey D. Smith;
Charles E. Alexson, all of P.O. Box
33427, St. Paul, Minn. 55133-3427

[21] Appl. No.: 692,886

[22] Filed: Jul. 24, 1996

Related U.S. Application Data

[62] Division of Ser. No. 258,338, Jun. 10, 1994, Pat. No.
5,553,675.

[51] Int. Cl.⁶ ----- H01M 2/10

[52] U.S. Cl. ----- 429/97; 429/98; 429/99

[58] Field of Search ----- 429/96-100; 30/500.
30/DIG. 1; 206/703, 705; 310/50; 318/139

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US005792573A

[11] Patent Number: 5,792,573

[45] Date of Patent: Aug. 11, 1998

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Product brochure entitled: "The K-100 Mini-Driver System. Cleaning and Lubrication", by 3M Surgical Products Division (5 pages). (No Date).

Product brochure entitled: "Cordless 800 Wire Driver", by Dyonics. 1984. (2 pages). (No Month).

Product brochure entitled: "Cordless 200 Reamer", by Dyonics. 1984. (2 pages). (No Month).

Product brochure entitled: "Cordless 450 Orthopaedic Drill", by Dyonics. 1984. (2 pages). (No Month).

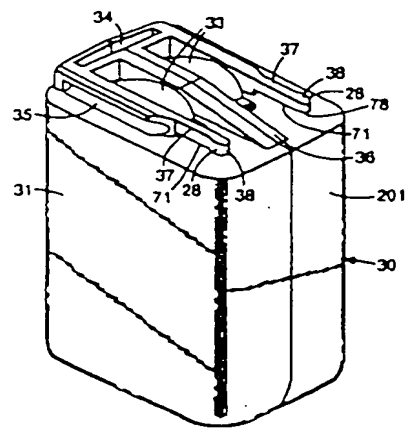
Product brochure entitled: "Mini-Driver™ Air Instrument System", by 3M. 1975. (4 pages). (No Month).

(List continued on next page.)

Primary Examiner—Anthony Skapers
Attorney, Agent, or Firm—Gary L. Griswold; Walter F. Kim; Jeffrey J. Hobenshell

[57] ABSTRACT

A cordless drive assembly for driving various orthopedic surgical instruments is described. The drive assembly is battery powered and includes tracks in the handle portion of its housing for receiving the battery. A latch locks the battery to the housing.



OTHER PUBLICATIONS

Product brochure entitled: "Acculan", by Aesculap®, (4 pages). (No Date).

Product brochure entitled: "Cordless Sagittal Saw", by Dyonics, 1984. (2 pages). (No Month).

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Operating Instructions entitled, "Mark III Electric Tool". by Avery Dennison. (12 pages). (No Date).

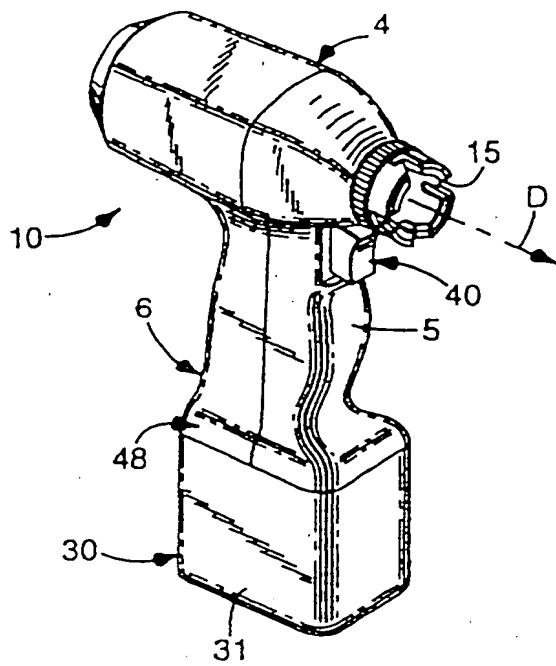


Fig. 1

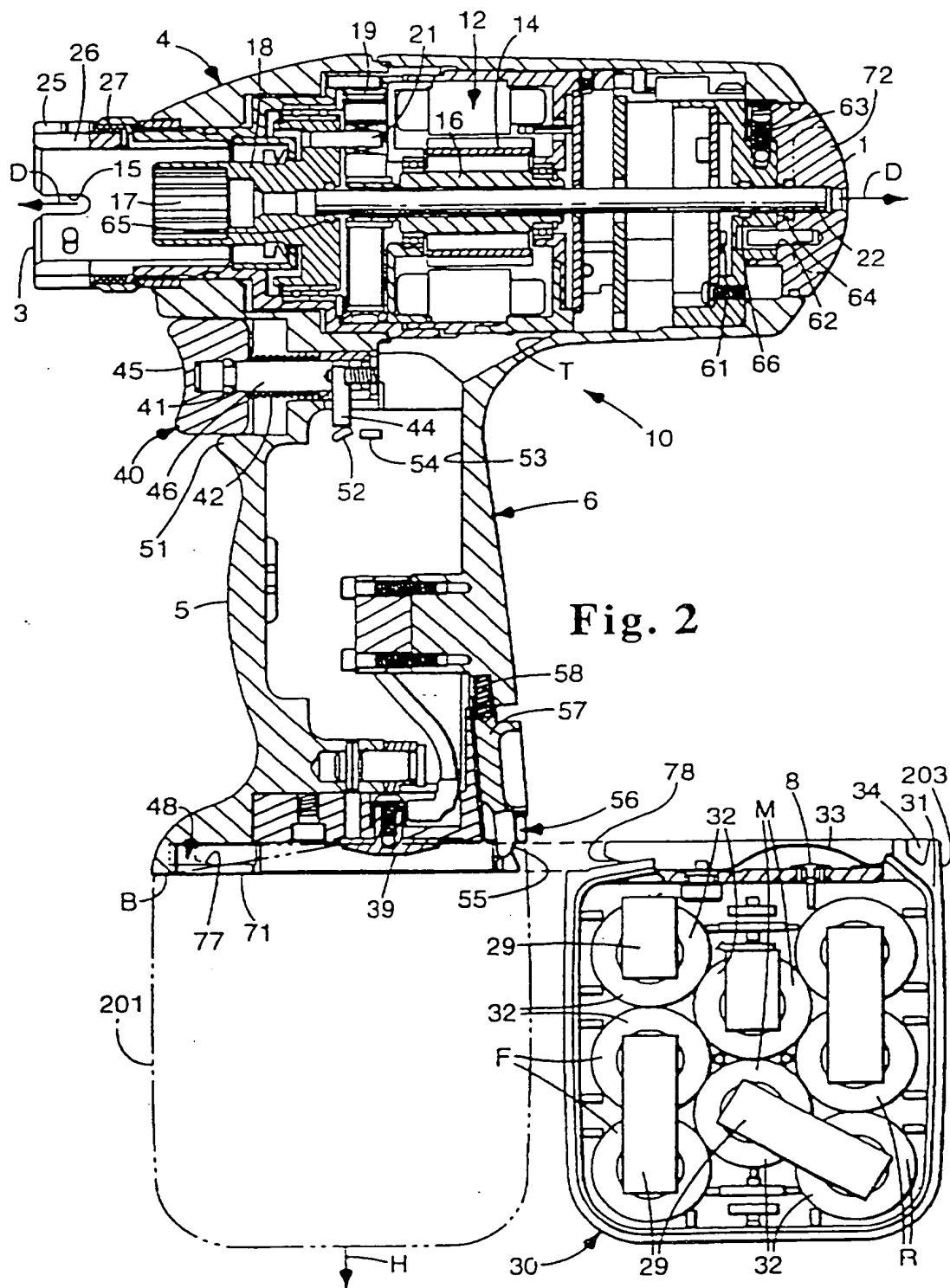


Fig. 2

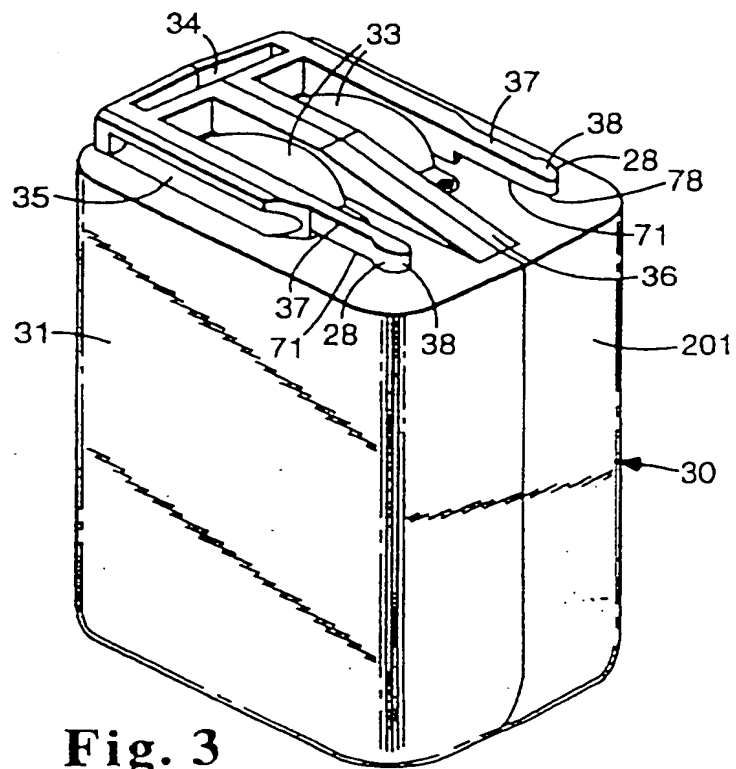


Fig. 3

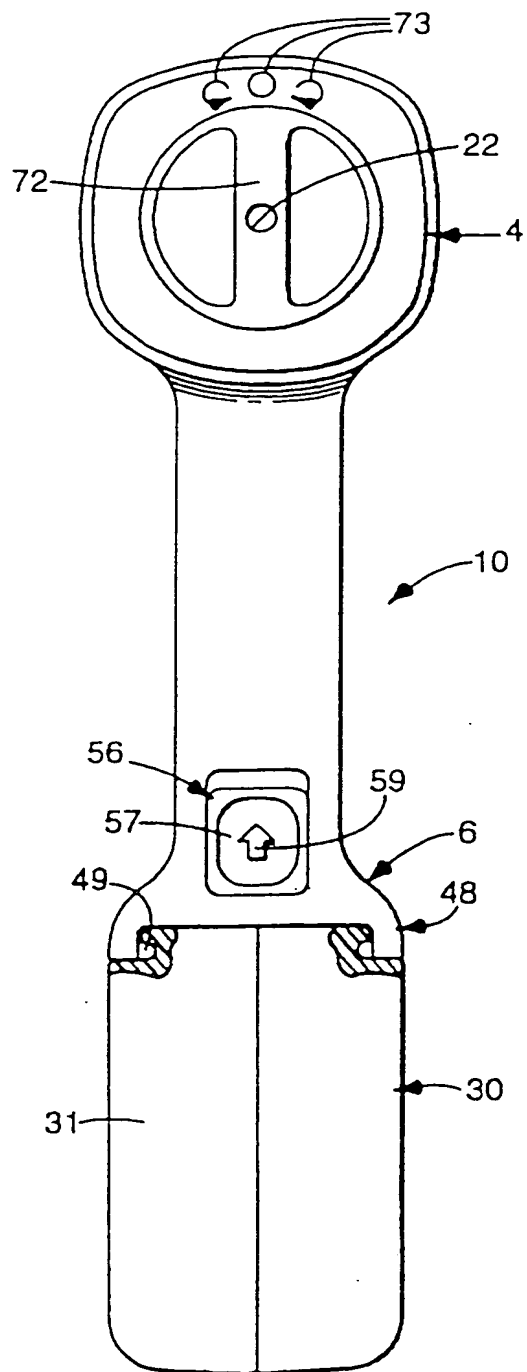


Fig. 4

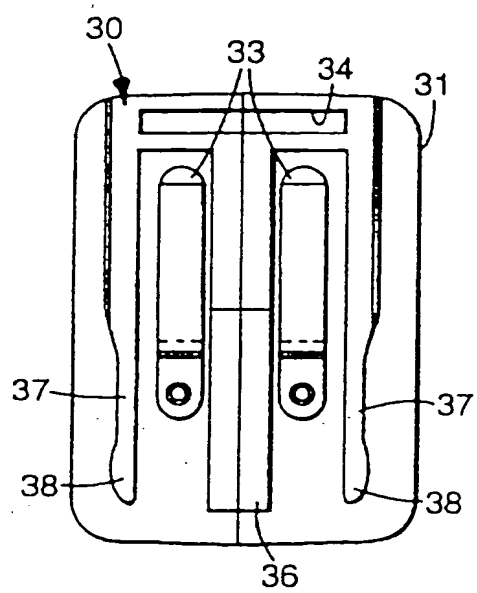


Fig. 5

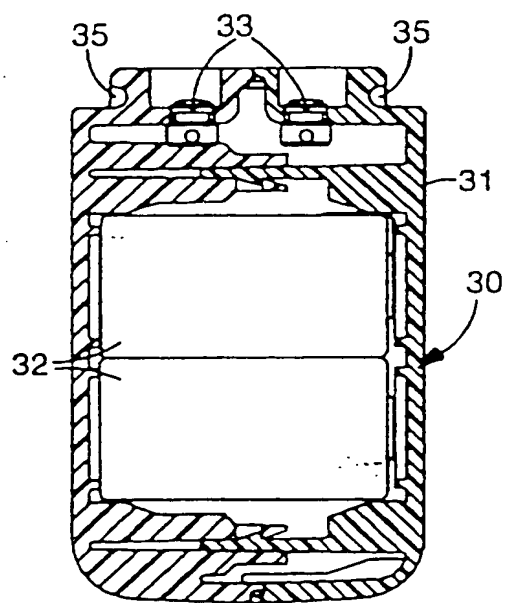


Fig. 6

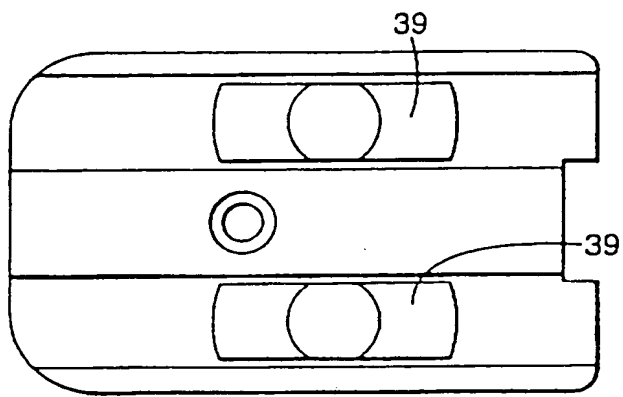


Fig. 6A

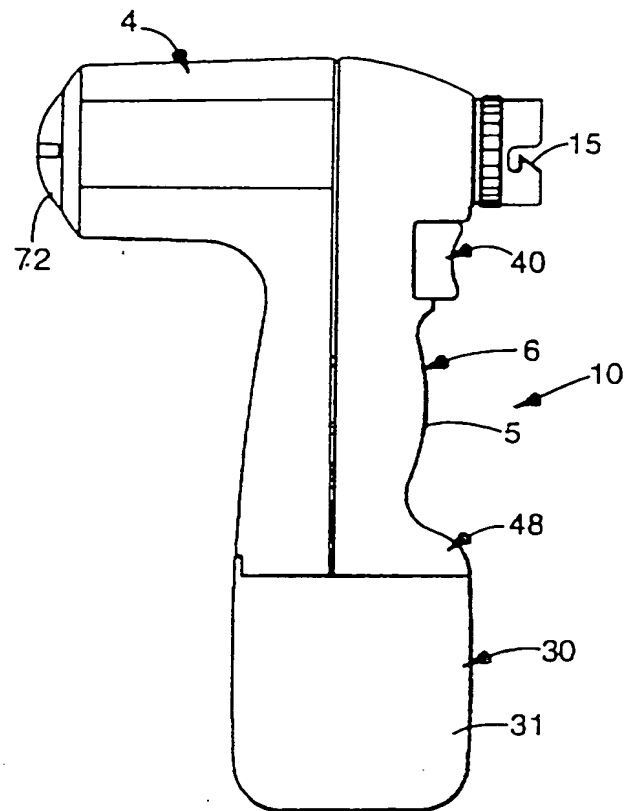


Fig.7

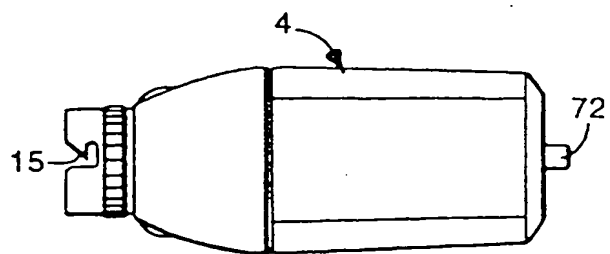


Fig.8

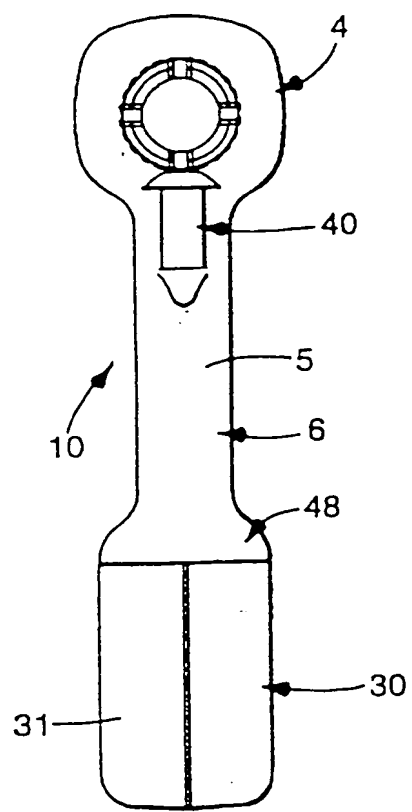


Fig. 9

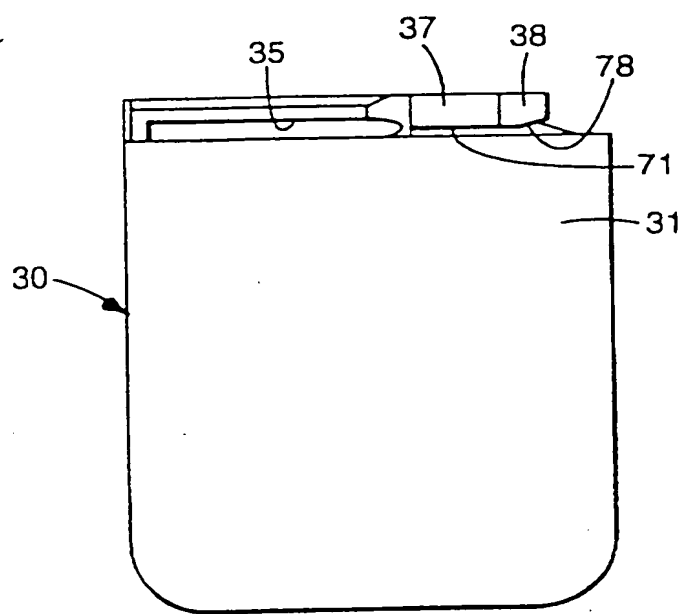


Fig. 10

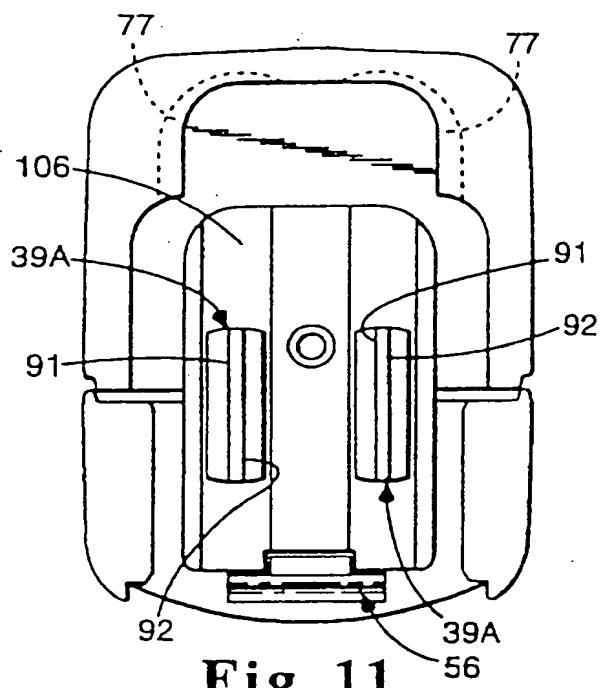


Fig. 11

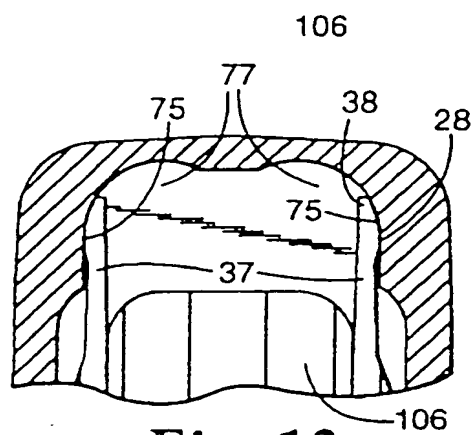


Fig. 12

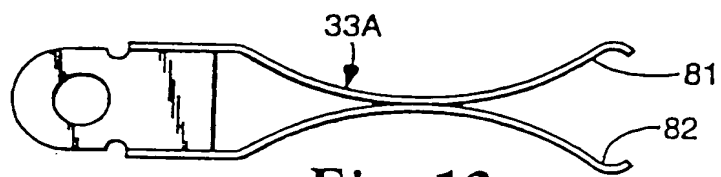


Fig. 13

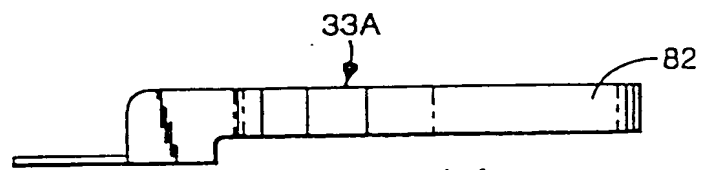


Fig. 14

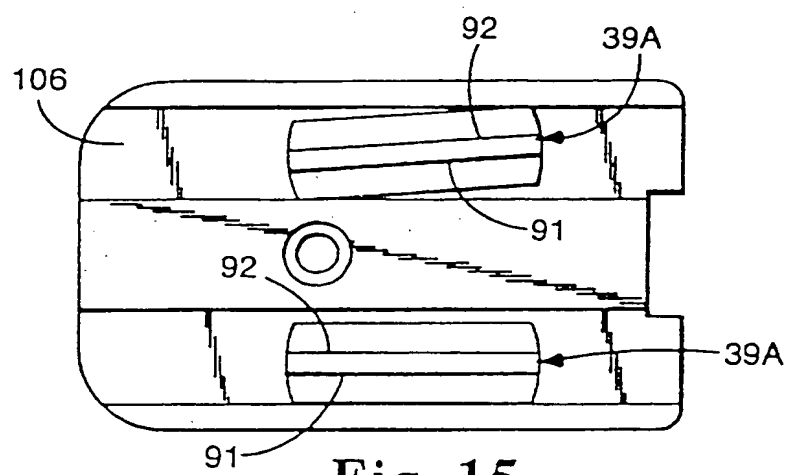


Fig. 15

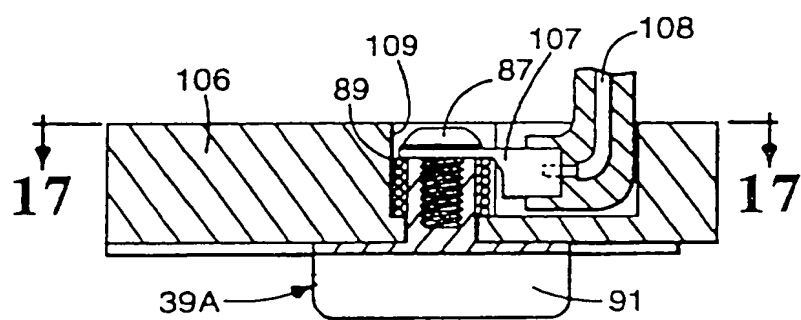


Fig. 16

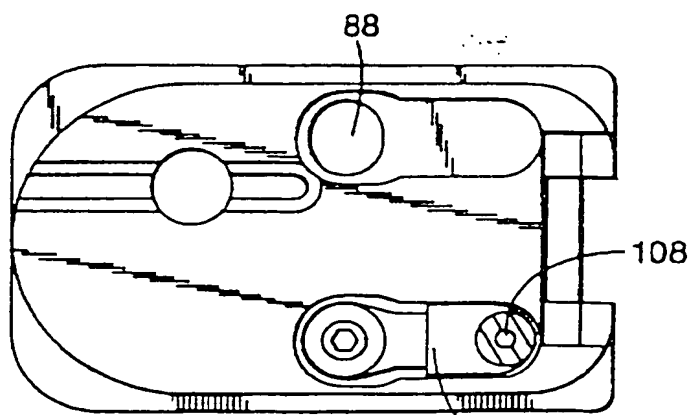


Fig. 17

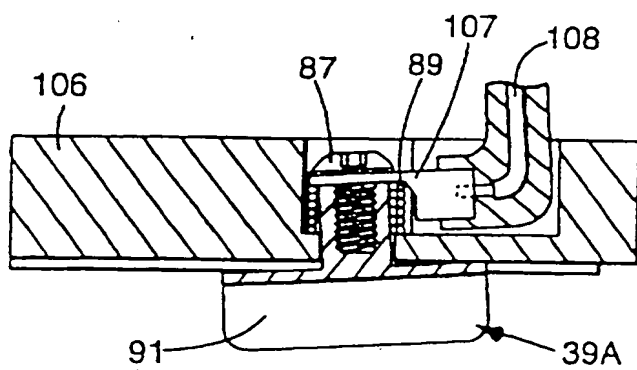


Fig. 18

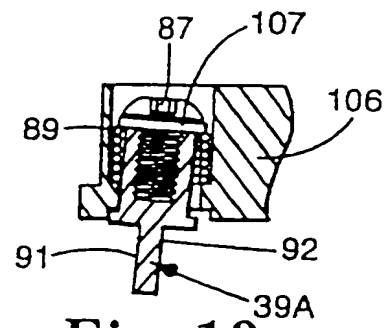


Fig. 19

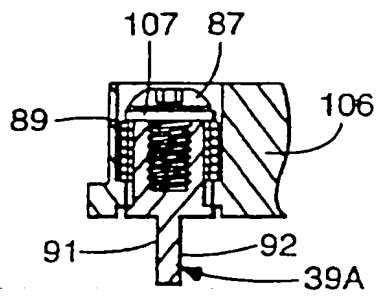


Fig. 20

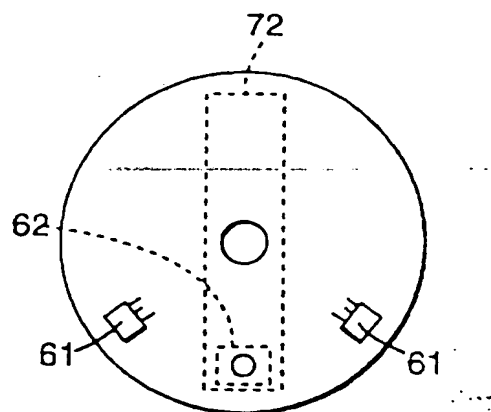


Fig. 21

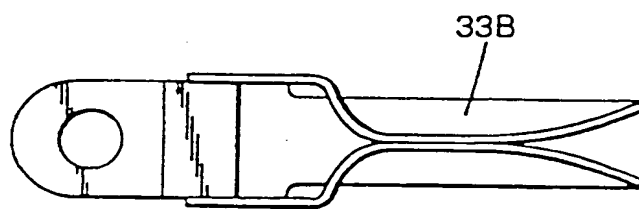


Fig. 22

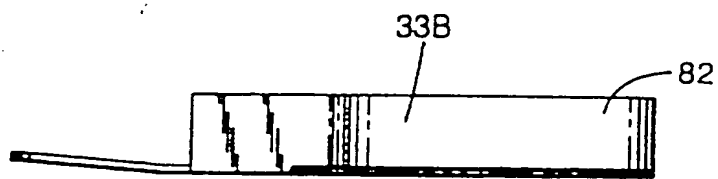


Fig. 23

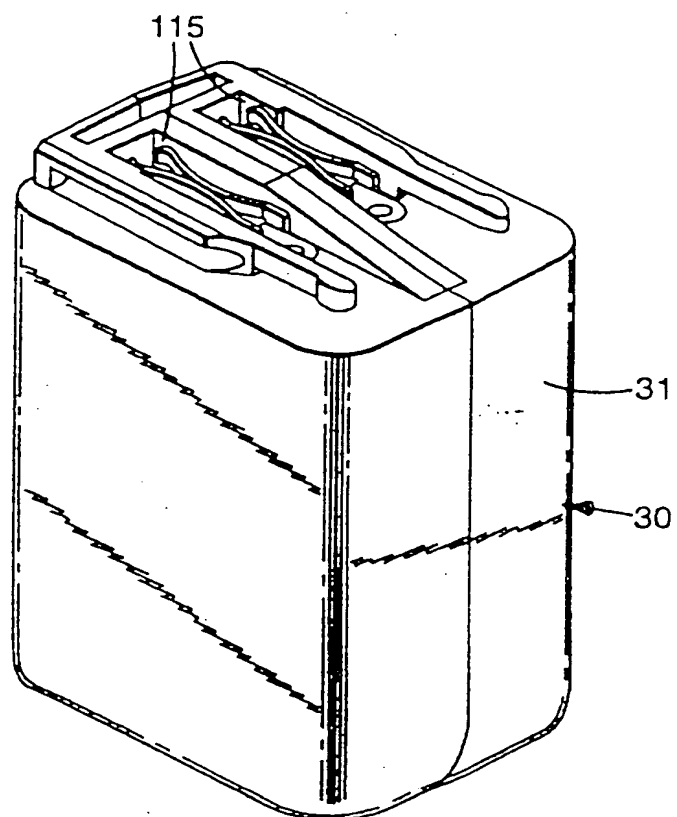


Fig. 24

RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO ORTHOPEDIC DEVICE

This application is a divisional of U.S. patent application Ser. No. 08/258,338, filed Jun. 10, 1994, now U.S. Pat. No. 5,553,675, issued Sep. 10, 1996.

TECHNICAL FIELD

The present invention is directed to cordless rechargeable battery powered drive assemblies for driving orthopedic surgical instruments.

BACKGROUND

Orthopedic drive assemblies are well known in the art. Such drive assemblies may be adapted for various orthopedic procedures such as drilling, screwing, reaming, wire driving, pinning and sawing (both reciprocating and sagittal). Typically a drive assembly is powered by either a rechargeable battery system (e.g. a cordless system) or by a pneumatic system which utilizes compressed fluid to power the device.

The art is replete with cordless rechargeable battery powered drive assemblies for driving orthopedic surgical instruments. Typically, such instruments comprise generally pistol-shaped devices having elongate handle and drive portions. Examples of such drive assemblies comprise: (1) the Orthopower 90 cordless instruments available from Stryker of Kalamazoo, Mich.; (2) the Cordless 200 Reamer, Cordless 800 Wire Driver, Cordless Sagittal Saw or Cordless 450 Orthopedic Drill available from Dyonics of Andover Md.; (3) the Maxion™ orthopedic drive device, previously sold by the Minnesota Mining and Manufacturing Co. (3M) of St. Paul, Minnesota; (4) the Hall Versipower orthopedic instruments available from Hall Surgical of Carpinteria California (associated with Zimmer); and (5) the product known as the 200 Reamer, previously sold by Black & Decker. Cordless battery powered drive assemblies for driving orthopedic surgical instruments are described in U.S. Pat. Nos. 3,734,207; 4,050,528; 4,091,880; 4,441,563; 4,641,076; 4,728,876 and 5,080,983.

Because the batteries in an orthopedic drive device are preferably rechargeable, releasable attachment means are provided in some prior art devices for releasably attaching a battery pack to the rest of the device. Typically, a battery pack is attached to and removed from the handle portion of the device in a direction that is substantially parallel to the axis of elongation of the handle portion. Individual batteries are placed in a housing creating the battery pack which is then attached to the device by being slid in a direction generally parallel to the elongate axis of the handle portion of the device. The battery pack typically includes electrical circuit connection means for connecting the battery pack to electronic circuitry in the device. A device typically secures the battery pack to the rest of the device.

While such releasable attachment means are generally acceptable, they leave room for improvement. One drawback of such a releasable attachment means is that gravity tends to continuously operate on the battery pack to urge it out of the device. Another drawback for some prior devices is that, because of the significant vibration forces encountered during use of the orthopedic drive assembly (particularly during sagittal sawing), the electrical circuit connection means tend to corrode. This type of corrosion is known as fretting corrosion. As used herein, the phrase "fretting corrosion" means surface degradation occurring at the interface of mating electrical contacts which results in the reduction or even loss of electrical continuity.

Fretting corrosion is found in components forming contacts which are allowed to move independently with respect to each other during current flow. This independent movement is believed to cause mechanical abrasion which will wear the surfaces. Gaping between the electrical contacts during electrical flow may result in electrical arcing with attendant generated heat potentially sufficient to melt the surface of the contacts. Pitting, welding and burning may also result. Also, a physical change in the material forming the contacts may occur. Plating for enhanced electrical contact may be lost and carbon deposits may accumulate resulting in reduced electrical continuity.

Because orthopedic drive assemblies are used in surgical procedures which require delicate yet physically demanding tasks, the balance and maneuverability of an orthopedic drive device is also important to surgeons. Hand fatigue is a problem associated with many existing drive assemblies as well as a general difficulty in maneuvering the device during some surgical procedures. Weight distribution and size considerations are believed to contribute to these problems, as the typical cordless rechargeable battery powered drive assembly may be cumbersome to hold and use, particularly during a delicate orthopedic procedure where only the highest quality is tolerated. Size and weight considerations involved in the placement of elements such as the batteries, transmission, electronic control circuitry and motor typically render an existing device difficult to maneuver.

Other prior art drive assemblies are excessively large. Oversized drive assemblies may be difficult to maneuver, particularly during a surgical procedure at a cramped or remote location.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention there is provided a drive assembly for driving orthopedic surgical instruments which (1) affords excellent balance and maneuverability for a user which offers enhanced handling characteristics and convenience during use, (2) affords attachment and removal of a battery pack in a direction other than the direction of elongation of the handle portion of the device, (3) includes a connection between the battery pack and the electronic circuitry of the device which resists fretting corrosion, (4) includes an ergonomically designed handgrip shape that fits a surgeon's hand comfortably, and (5) is sized for convenient maneuvering during an orthopedic surgical procedure.

According to the present invention, there is provided a drive assembly for driving various orthopedic surgical instruments, such as, but not limited to, drills, screws, reamers, wires, pins and saws (both reciprocating and sagittal). The drive assembly comprises a housing having elongate drive and handle portions with the handle portion projecting from the drive portion. A drive is present comprising an motor preferably mounted within the drive portion. The motor has a motor shaft, and the drive includes a transmission for transmitting power of the motor shaft to the surgical instrument. The transmission includes a drive member. Preferably the drive portion has surfaces defining a wire receiving chamber adapted to receive an orthopedic wire adapted to be driven during an orthopedic surgical procedure.

The drive assembly also includes a trigger assembly movable relative to the handle portion; and electrical circuit means operatively associated with the trigger assembly for controlling the motor.

The handle portion comprises a releasably attachable battery having at least one cell (preferably eight), a battery

housing, and a pair of battery contacts. The handle portion also has a battery receiving portion having battery terminals adapted to engage the battery contacts; and releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion. Preferably, the direction is a direction substantially parallel to the axis of the drive portion.

In the preferred embodiment, the releasable attachment means comprises a) the handle portion having a pair of tracks defining flanges that are elongate in a direction substantially parallel to the longitudinal axis of the drive portion, b) the battery having a pair of grooves adapted to receive the flanges of the tracks, and a pair of flexible, resilient cantilever members, and c) the battery receiving portion having surfaces defining a cantilever member cavity for receiving the pair of flexible, resilient cantilever members in an interference fit so that the battery is frictionally held in place relative to the battery receiving portion. A latch for releasably securing the battery to the battery receiving portion is also preferably present.

The drive assembly also includes a novel floating battery terminal assembly comprising biasing means for biasing the battery terminals toward a rest position, and mounting means for mounting the battery terminals for deflection from the rest position. In one embodiment, each of the battery terminals comprises a substantially flat plate member having opposite side surfaces, and each of the battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

Also preferably, the handle portion comprises a handgrip portion having outer surfaces that are sized and shaped to be grasped by a user without touching the battery, and inner surfaces defining a handgrip cavity. The handgrip cavity is free of the transmission, the motor and any cells of the battery when the battery is received in the battery receiving portion. Preferably, the cells of the battery are spaced on an opposite end of the handgrip portion than the motor and transmission.

Alternatively, the present invention may be described as a rechargeable battery adapted to be repeatably and releasably attached to an orthopedic drive assembly. In this aspect of the invention, the orthopedic drive assembly has elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and surfaces defining a cantilever member receiving cavity.

The battery comprises an autoclavable battery housing having opposite top and bottom portions, at least one cell within the battery housing, and a pair of battery contacts mounted adjacent the top portion of the housing and adapted to engage the battery terminals of the orthopedic drive assembly. Releasable attachment means are present for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion. The releasable attachment means and battery terminals comprise the preferred versions as discussed above.

In this aspect of the invention, the battery contacts each include a first end fixedly attached to the top portion of the battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing. The battery housing comprises opposite, substantially flat front and rear walls constructed from a material suitable for protecting the cell(s) during an autoclave procedure. The battery comprises eight substantially cylindrical cells having

longitudinal axes. The eight cylindrical cells are arranged in:
 a) a front row of three cells substantially adjacent a front
 wall of the battery housing, b) a rear row substantially
 adjacent a rear wall of the battery housing, and c) a middle
 row of two cells between the front and rear rows.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further described with
 reference to the accompanying drawing wherein like refer-
 ence numerals refer to like parts in the several views, and
 wherein:

FIG. 1 is a perspective view of a drive assembly for
 driving orthopedic surgical instruments according to the
 present invention;

FIG. 2 is an enlarged sectional view of the drive assembly
 of FIG. 1, illustrating a battery pack of the device removed
 from the device in solid lines, and illustrating the position of
 the battery pack when attached to the drive assembly in
 phantom lines;

FIG. 3 is an enlarged perspective view of the battery pack
 for use in the drive assembly of FIG. 1;

FIG. 4 is an enlarged rear view of the drive assembly of
 FIG. 1;

FIG. 5 is a top view of the battery pack of FIG. 3;

FIG. 6 is a sectional view of the battery pack of FIG. 3;

FIG. 6A is a bottom view of portions of the drive
 assembly of FIG. 2 with the battery pack removed which
 illustrates battery terminals that are adapted to be connected
 to the battery contacts of the battery pack of FIG. 3;

FIG. 7 is an enlarged side view of the drive assembly of
 FIG. 1;

FIG. 8 is a top view of the orthopedic drive assembly of
 FIG. 7;

FIG. 9 is a front view of the drive assembly of FIG. 7;

FIG. 10 is a side view of the battery pack of FIG. 3;

FIG. 11 is an enlarged bottom view of a handle portion of
 a drive assembly with the battery pack removed to illustrate
 details of a second embodiment of battery terminals accord-
 ing to the present invention and with portions of a battery
 pack receiving cavity illustrated with dashed lines;

FIG. 12 is a partial sectional view of a battery receiving
 portion of the drive assembly and cantilever arms of the
 battery pack showing the position of the cantilever arms
 when the battery pack is attached to the rest of the ortho-
 pedic drive assembly;

FIG. 13 is a top view of one of a pair of preferred battery
 contacts for a battery pack according to the present
 invention, which battery pack is adapted to be connected to
 a drive assembly having the battery terminals of FIG. 11;

FIG. 14 is a side view of the battery contact of FIG. 13;

FIG. 15 is an enlarged bottom view of portions of the
 handle portion of the drive assembly of FIG. 11 which
 illustrates details of a pair of floating battery terminal
 assemblies including a battery terminal of one of the assem-
 blies shown offset relative to the axis of the drive portion of
 the housing of the device;

FIG. 16 is a sectional view of a floating battery terminal
 assembly of FIG. 15 which illustrates details of a battery
 terminal in a rest position;

FIG. 17 is a sectional view of portions of the drive
 assembly of FIG. 16 taken approximately along lines
 17-17 of FIG. 16 except that one battery terminal and
 connector are removed to illustrate details of a hole for
 receiving the battery terminal;

FIG. 18 is a sectional view similar to FIG. 16 except that the floating battery terminal assembly is slightly offset from its rest position, as may occur during vibration of the orthopedic drive device;

FIG. 19 is a sectional view of the floating battery terminal of FIG. 17 with the battery terminal offset laterally with respect to its longitudinal axis in a rest position and with other portions omitted to illustrate details;

FIG. 20 is a sectional view of the floating battery terminal assembly of FIG. 17 with the battery terminal illustrated in a rest position and with other portions omitted to illustrate details;

FIG. 21 is a schematic illustration of a switch mechanism for use in the drive assembly according to the present invention;

FIG. 22 is a top view of another embodiment of battery contact for use with a drive assembly having the battery terminals of FIG. 11;

FIG. 23 is a side view of the battery contact of FIG. 22; and

FIG. 24 is a perspective view of a battery with the battery contacts of FIGS. 13 and 14.

DETAILED DESCRIPTION

Referring now to FIGS. 1 through 10 of the drawing there is shown an embodiment of a cordless rechargeable battery powered drive assembly for driving orthopedic surgical instruments according to the present invention, generally designated by reference character 10. The drive assembly 10 includes a housing comprising elongate drive 4 and handle 6 portions defining drive D and handle H portion longitudinal axes. The drive portion 4 and a significant portion of the handle portion 6 are constructed by assembling two large housing pieces (see FIG. 7) to afford convenient disassembly of the device for repair.

Referring now to FIG. 2, the drive assembly 10 includes a motor assembly having a D.C. electric powered motor 12 including a rotor 14 and a motor shaft 16. A drive is also present comprising a transmission for transmitting the power of the motor shaft 16 to the surgical instrument. The illustrated transmission includes a drive member or spindle 18, a ring gear 19, and a gear pin and planetary gear assembly 21.

Preferably, the motor 12 is mounted within the drive portion 4. As used in this application, when it is said that the motor is within the drive portion 4, it is meant that the rotor 14 and motor shaft 16 are substantially completely located within the structure of the housing defining the drive portion 4, as opposed, for example, to one of the rotor or motor shaft being located in the handle portion 6 or a substantial portion of the motor being located in the handle portion 6, of course some wires and electronic circuitry associated with the motor may be present outside the drive portion 4, and yet the motor will nevertheless be within the drive portion 4 as understood in the present invention. Also preferably, the transmission (e.g. 18, 19 and 21) is mounted within the drive portion 4.

A connector is provided for attaching a chuck or other such holder or instrument that may be driven by the drive assembly 10. The connector comprises a nose insert 26 having a socket into which a cylindrical portion of the surgical instrument can project with a splined central rotatable driven collar engaged with mating splines 17 on the inner surface of the drive member 18, and with pins (not shown) projecting radially of the cylindrical portion engaged

in longitudinally extending slots 15 opening through the end of the housing. A helix pin/collar assembly 25 is rotatable about the axis D of the drive portion and is biased by torsion spring 27 so that circumferentially projecting books near slots 15 on the collar 25 can engage the pins on the surgical instrument to maintain the pins within the slots 15 and thereby the surgical instrument in driven engagement with the drive assembly 10.

The surgical instrument may comprise any instrument suitable for use in an orthopedic surgical procedure, including but not limited to, drills, screws, reamers, pins and saws (both reciprocating and sagittal) or a suitably designed chuck or adapter for use with any of the previously mentioned instruments.

As a particular example, the surgical instrument may comprise the chuck described in U.S. Pat. No. 4,728,876, the entire contents of which are herein expressly incorporated by reference. Alternatively, for example, an appropriate wire driving attachment adapter may be attached to the drive assembly 10 so that it may be used as an orthopedic wire driver. optionally, but not preferably, engagement between the orthopedic wire and the spindle 18 may afford operation of the device 10 as a wire driver.

A stationary member 22 extends from a proximal end 1 of the housing toward its distal end 3. Preferably, the stationary member 22 includes a through chamber so that a surgical wire may be passed through the stationary member 22 from the proximal end 1 of the device 10 toward the distal end 3. The through chamber in the stationary member 22 forms a portion of a wire receiving chamber in the drive portion 4 between the proximal end 1 and the distal end 3. Threading a surgical wire through the wire receiving chamber affords use of the device 10 as a wire driver.

O-rings 64 and 65 restrict internal contamination of the drive assembly 10 from ambient contaminants. O-ring 66 is compressed against member 22 to restrict the member 22 from rotating relative to the handle 6 and drive 4 portions of the housing.

The drive assembly 10 also includes a rechargeable battery or battery pack 30 that is adapted to provide a rechargeable source of power for the motor 12. Unique mounting means (described in greater detail below) attach the battery 30 to the rest of the assembly 10.

A trigger assembly 40 is movable relative to the handle portion 6. The trigger assembly includes a button member 45 adapted to be engaged by a user's digits, a trigger shaft 46, an O-ring seat 41 for fixedly connecting the button member 45 to the trigger shaft 46, a coil spring 42 and magnet 44 that is rigidly attached to the trigger shaft 46. The trigger assembly 40 is movable between a released or extended position (FIG. 2) and a depressed or inner position relative to the handle portion 6.

The drive assembly 10 also includes electrical circuit means operatively associated with the trigger assembly 40 for controlling the motor 12. The illustrated electrical circuit means comprises an on/off hall sensor 52 and a speed control hall sensor 54.

The on/off hall sensor 52 is a digital hall sensor having an output signal with two levels corresponding to an on state and an off state. The on/off hall sensor 52 senses the presence of a magnetic field from the magnet 44 on the trigger assembly 40. When the trigger assembly 40 is released, the magnet 44 is positioned directly over the on/off hall sensor 52 (FIG. 2). The magnetic field of the magnet 44 causes the on/off hall sensor 52 to produce an output signal corresponding to an off state. As the trigger assembly 40 is

depressed, the magnet 44 moves away from the on/off hall sensor 52, no longer sensing the presence of a magnetic field, produces an output signal corresponding to an on state.

The output signal from the on/off hall sensor 52 is conditioned by electrical circuitry which provides a standby signal when the on/off hall sensor 52 produces an off signal. The standby signal disables motor drive circuitry and the speed control hall sensor 54. The standby signal therefore ensures that the motor 12 is off whenever the trigger assembly 40 is in a released position (FIG. 2). An added benefit of disabling the motor drive circuitry and the speed control hall sensor 54 is that the electrical power required by the device 10 is significantly reduced during periods when the trigger assembly 40 is not depressed. This current reduction during a standby mode improves energy efficiency of the device 10. In this manner, the device 10 may optionally include a battery saver feature.

The speed control hall sensor 54 is a linear hall sensor which provides a speed control signal having a range of levels based upon the strength of the magnetic field that the variable speed hall sensor 54 detects. As the strength of the magnetic field increases, the speed control hall sensor 54 produces a speed control signal with a higher level. As the trigger assembly 40 is depressed, the magnet 44 moves towards the speed control hall sensor 54 and increases the magnetic field across it. The speed control signal from the speed control hall sensor 54 is conditioned and drives the motor control circuit to provide motor speeds proportional to the speed control signal. Therefore, as the trigger assembly 40 is further depressed, the motor control circuitry increases the motor speed of the drive assembly 10. In this manner, the drive assembly 10 may optionally comprise a variable speed device.

The circuit has a 25 amp current limit to protect the batteries, motor and electronics. The electrical circuit means may optionally include directional drive circuitry which is discussed in greater detail below.

As best seen in FIGS. 2 and 6A, the device 10 also comprises battery terminals 39. Each of the battery terminals 39 have three generally flat surfaces including two end surfaces situated at an angle relative to a middle surface. The function of the battery terminals 39 will be described in greater detail below.

The battery terminals 39 may be constructed from any suitable material appropriate for use to construct orthopedic surgical tools. For example, the battery terminals may be constructed from copper, brass, bronze, beryllium copper, stainless steel, steel and aluminum. One or more platings may be present to enhance the electrical conducting and corrosion resisting properties of the battery terminals 39. Examples of such platings include, but are not limited to copper, nickel, gold, silver, tin, electroless nickel, rhodium, sulfamate, nickel, cadmium and zinc.

The handle portion 6 of the device 10 projects (downwardly in FIG. 2) from the drive portion 4 of the device 10. The handle portion 6 of the housing comprises the battery 30 and a handgrip portion 5. The handgrip portion 5 has manually engageable or graspable surfaces and top T and bottom B ends (see FIG. 2). Preferably, the handgrip portion 5 is sized and shaped so that, during use of the device 10, the user does not need to grasp any portion of the battery 30. For example, the handgrip portion 5 may have a height from its bottommost point to the bottom of the drive portion 4 of less than approximately 6 inches (preferably about 4.5 inches), a width of its neck portion of less than about 2.8

inches (preferably about 1.1 inches), and a length of its neck portion of less than about 2.5 inches (preferably about 1.3 inches).

The handgrip portion 5 includes specially shaped surfaces that result in a handle that is comfortably held in the hand of a surgeon. A middle part of the handgrip 5 includes an curved front surfaces to form a conveniently held handle. A lip portion 51 is situated adjacent the button member 45 to restrict the chance that a surgeon's glove may be caught between the handle portion 6 and the button 45 when the button 45 is depressed.

As shown in the figures, the width and length of the handgrip portion 5 vary along its height to afford convenient grasping of the device 10. The bottom of the handgrip portion 5 includes a battery receiving portion 48 having the battery terminals 39 adapted to engage battery contacts 33 (described in greater detail below) when the battery 30 is attached to the battery receiving portion 48.

A battery housing 31 (FIGS. 2 and 3) preferably comprises opposite, substantially flat front 201 and rear 203 walls constructed from an autoclavable material. An autoclavable material is a material suitable for protecting battery cell(s) during repeated autoclave procedures. Examples of suitable materials are described below.

The battery 30 comprises at least one rechargeable cell 32 and preferably eight substantially cylindrical cells 32 as shown in FIG. 2. Because the cells 32 are located in a position below or remote from where a user is expected to grasp the drive assembly 10, the handgrip portion is free to be used for mounting other electrical and/or mechanical components such as an electronic printed circuit board forming a portion of the electrical circuit means discussed above.

The battery 30 preferably comprises eight substantially cylindrical cells 32 having longitudinal axes. The axes of the cells are preferably substantially parallel to the front and rear walls 201 and 203. The eight cylindrical cells 32 are arranged in a front row F of three cells substantially adjacent the front wall 201, a rear row R of three cells substantially adjacent the rear wall 203, and a middle row M of two cells between the front and rear rows 201 and 203. All of the rows F, M and R are enclosed within the battery housing 31 so that the cells are protected during an autoclave or other sterilization procedure.

The weight distribution of the device 10 is substantially balanced about the handgrip portion 5 as the relatively heavier elements such as the battery cells and the motor/transmission assemblies of the device 10 are spaced on opposite ends (top T and bottom B) of the handgrip 5. A handgrip cavity 53 is formed within the inner portions the handgrip 5. As opposed to prior art devices which include a battery or motor within the portion of its housing that is designed to be manually grasped, the cavity 53 is free of batteries or motors or transmission or gear assemblies. Since battery cells 30 (described in greater detail below) are situated below the battery receiving portion of the handle portion 6, some of the electronic control circuitry mentioned above may be placed in the handgrip cavity 53 of the handle portion 6. This is believed to further contribute to the beneficial balance and handling characteristics of the device 10.

The cells 32 are preferably stacked in the manner shown in FIG. 2, with a distal row of three cells placed at the front of the battery 30, a proximal row three cells at the rear of the battery 30, and a middle row of two cells placed between the front and rear cells. The axes of the cells are perpendicular

to the axis D of the drive portion of the housing. The cells 32 may comprise, for example, nickel-cadmium secondary (rechargeable) sub "C" size cells with a 22 mm diameter and a 34 mm length in a nickel-plated steel case. Such cells are expected to provide a capacity of about 1.4 amp hours at 9.6 volts, D.C. Suitable cells may be obtained from Saft of Valdosta, Ga.; Panasonic of Japan; Sanyo Electric Co. Ltd. of Sumoto-City, Hyogo Japan or Gates available from DC Battery Products of St. Paul, Minn.

The cells 32 are enclosed in an autoclave proof (saturated steam @ 280 degrees Fahrenheit @ 30 pounds per square inch, and vacuum @ 26 inches of mercury) housing or casing 31. The casing 31 preferably is designed to withstand other sterilization techniques and remain suitable to protect the battery cells 32. The casing 31 includes a poppet or umbrella valve 8 (e.g. the #VL2491-102 Vernay valve generally available from Vernay of Calif.) to relieve any pressure, such as pressure generated by the cells 32. Optionally, the battery housing 31 may include a power terminal (not shown) for a power cord so that the drive assembly 10 may be powered without discharging the cells 32.

The particular material used to construct the casing 31 may comprise any suitable material for use in an orthopedic device. Specific examples include, but are not limited to, poly-ether-imide (PEI) including Ultem (e.g. GE grades 1000 Black #7101, 1000 Black #1000, 2100 muddled natural #1000 10% glass fill, 2200 muddled natural 20% glass fill, 3452 muddled natural #1000 45% short glass and mineral, or 6200 muddled natural #1000 20% glass fill high temperature); poly-phenyl-sul-fone (PPSU) (e.g. Amoco Radel R, grades R5100 Black #935 or #937, or R 5000, natural); polysulfone (PSU) (e.g. Amoco Udel P, grade P 1700, natural #11); polyaryletherketone (PAEK) (e.g. BASF Ultrapek, grade KR4176, natural); liquid crystal polymer (LCP) (e.g. Vectra grades A950 natural, A530 muddled natural moderately mineral filled, or A130 muddled natural 30% glass fill); and polyketone (PEK) (e.g. Amoco Kadel E grade 1000 natural).

The motor 12 of the drive assembly 10 is designed to: (1) operate between about 9.6 volts and a reduced voltage which is the output range the battery will produce under load, and (2) have very low internal resistance to restrict internal losses when handling the high current flow by which it is powered. Since the motor 12 and transmission are relatively heavy elements of the device 10 (e.g. the motor may weight about 0.82 pounds), the motor 12 and transmission are preferably located within the drive portion 4 of the housing. Locating the motor 12 and transmission in a position spaced from the handgrip cavity 53 frees the handgrip cavity 53 for use to store the electronic circuitry of the device 10. The location of the motor 12 and transmission also contribute to the beneficial balance and weight distribution of the device 10 and improves its handling characteristics. These improvements are believed to reduce hand fatigue for some users.

The battery 30 shown in FIGS. 1-7, 9 and 10 comprises the battery housing or casing 31, and a pair of battery contacts 33, one of which is an electrically positive terminal, the other of which is an electrically negative terminal. The battery contacts 33 comprise thin, arcuate contact members. The arcuate contact members 33 are connected at one end to the housing 31 and are in electrical communication with the cells 32 (which are connected in series by electrically conductive strips). The other end of the contact members 33 is free to float along the top of the casing 31. Preferably, the contacts 33 are constructed from a flexible, resilient elec-

trically conductive material, such as a material selected from the group comprising copper, brass, bronze, beryllium copper, nickel, stainless steel, aluminum or steel. Optionally, one or more materials may be plated to the contacts to enhance their performance and corrosion resistance. Plating materials include, but are not limited to gold, copper, nickel, silver, tin, electroless nickel rhodium, sulfamate nickel, cadmium and/or zinc. The shape of the arcuate contact members 33 afford their resilient deflection in a direction substantially parallel to the axis H of the handle portion 6 of the housing upon abutment with the battery terminals 39.

Referring now to FIGS. 11, 13-14, 15-16, 18-20 and 24 of the drawings, there is shown a second embodiment of cooperable battery terminals and battery contacts according to the present invention with the battery contacts designated with reference character 33A and the battery terminals designated by reference character 39A.

As best seen in FIG. 16, handgrip 5 has a portion constructed from an electrically insulating material 106. The battery terminals 39A are each attached to the insulating material 106 by screw 87. A crimp-on connector 107 is situated between the screw 87 and the battery terminal 39A. The crimp-on connector 107 places the battery terminal 39A in electrical communication with the rest of the electrical circuit means by virtue of insulated wire 108.

The battery terminals 39A are mounted on the manually graspable portion 5 of the housing to float relative to the rest of the housing (including the insulating portion 106). This feature is particularly useful when the device 10 generates vibration as the floating battery terminals 39A tend to retain electrical communication between the battery 30 and the rest of the electronics of the device 10.

The battery terminal 39A is placed in an oblong hole 88 in the handgrip portion 5 of the housing. The oblong hole 88 preferably affords side to side float (movement in a direction that is substantially perpendicular to both axes H and D) of the battery terminal 39A (see FIG. 19), but restricts float of the battery terminal 39A in a direction substantially parallel to the axis D so that the battery terminal 39A is not unduly deflected upon insertion and removal of the battery 30 from the device 10.

A coil spring 89 is provided to afford float of the battery terminal 39A and to bias the battery terminal 39A toward a rest position (see FIGS. 16 and 20). The coil spring 89 has a pair of ends, one of which abuts the crimp-on connector 107, and the other of which abuts the insulating portion 106 of the housing. A rest position of battery terminal 39A is shown in FIG. 16. When the battery terminal 39A is deflected from its rest position (such as when the device 10 vibrates during an orthopedic surgical procedure), the spring 89 deflects in compression from its rest position and biases the battery terminal 39 toward its rest position. Alternatively, the spring 89 may be designed to deflect in tension from its rest position to bias the battery terminal 39 toward its rest position.

The screw 87, crimp-on connector 107, coil spring 89 and portions of the battery terminals 39A are situated within cavity 109 in the handgrip 5. The cavity 109 has a diameter at least slightly larger than the diameter of the screw 87 to afford float of the battery terminals 39A. Unlike the battery terminals 39, the battery terminals 39A comprise a substantially flat, rectangular contact member having a pair of opposite sides 91 and 92 for contacting the battery contacts 33A.

Battery contact 33A for use with the battery terminals 39A is shown in FIGS. 13, 14 and 24. Each of the battery contacts

33A include a pair of flexible, resilient deflecting members 81 and 82. The flexible, resilient deflecting members 81 and 82 each have a first end rigidly affixed to the battery housing 31, and a second end, opposite the first end. The second end of the members 81 and 82 is free to slide along the top of the casing 31 when the members 81 and 82 are deflected. A support shoulder surface 115 of the top portion of the battery housing 31 receives the second end of the members 81 and 82 and affords sliding movement of the second ends of the members 81 and 82.

The battery terminal 39A is designed to be sandwiched between the flexible, resilient deflecting members 81 and 82 and to deflect the members 81 and 82 in a direction that is substantially perpendicular to both of the axes H and D during vibration of the battery terminals 39A. Preferably, side 91 of the battery contact 33A is in electrical communication with deflecting member 81, and side 92 of the battery contact is in electrical communication with deflecting member 82.

The battery contacts 33A are constructed from a flexible, resilient, electrically conductive material. Any of the materials and platings mentioned above for use in constructing the battery contacts 33 may be used to construct the battery contacts 33A. Particular examples include beryllium copper, Brush Wellman alloy 25, 0.0159 (26 Ga) thick, ¼ H temper, or equivalent UNS No. C17200, (ASTM temper TD01) heat treated 2 hours @ 600 degrees Fahrenheit (ASTM TH01), R/C 38-43. As an example not intended to be limiting, the contacts 33A may have an overall height in FIG. 14 of about 0.17 inches, a overall length (FIG. 13) of about 1.44 inches and an overall width of approximately 0.32 inches.

FIGS. 22 and 23 illustrate another embodiment of battery contact 33B for use with a drive assembly having the battery terminals of FIG. 11. The battery contact 33B is similar to the battery contact 33A except in that the contact 33B has a slightly different shape when viewed in the top view.

The handle portion 6 of the housing has a releasable attachment means for releasably attaching the battery 30 to the battery receiving portion 48 in a direction other than the direction of elongation of the handle portion 6. In the illustrated embodiment, that means comprises surfaces on the battery receiving portion 48 defining track portions 49 with flanges that are elongate in a direction substantially parallel to the longitudinal axis D of the drive portion. The battery 30 has a pair of opposite mounting grooves 35 adapted to cooperably receive the flanges of the track portions 49 (see FIGS. 4 and 6).

The battery pack 30 also has a pair of flexible, resilient cantilever members 37 having opposite ends. Each of the cantilever members 37 has a first end attached to the battery housing 31 and an enlarged distal end 38. The cantilever members 37 project from the structure defining the grooves 35 in a direction other than direction of elongation of the handle portion 6 (preferably in a direction substantially parallel with the top of the battery and the drive portion axis D). Referring now to FIG. 11, the battery receiving portion 48 of the housing includes a cantilever member receiving cavity 77 formed in part by a relatively thin shelf. The cantilever member receiving cavity 77 includes radiused side walls 75 (see FIG. 12).

The flexible, resilient cantilever members 37 are shown mounted in the cantilever member receiving cavity 77 in FIG. 12. When the battery 30 is mounted on the battery receiving portion 48, the flexible, resilient cantilever members 37 interfere with the surfaces defining the cantilever member receiving cavity 77 to resist movement of the

battery 30 relative to the rest of the device 10, particularly movement in the D axis direction. The flanges of the track 49 cooperably engage the grooves 35 and prevent the battery 30 from separating from the rest of the device 10.

5 The distal ends 38 of the flexible, resilient cantilever members 37 have a bevel 78 to allow them to ramp onto the shelf forming the cavity 77. The engagement between the bevel 78 and the shelf forming the cavity 77 forces the flexible, resilient cantilever members 37 upward in the H
10 axis direction (in FIG. 2) when the battery 30 is mounted in the battery receiving portion 48. Consequently, the battery 30 is forced into abutment with the manually grasping portion 5. When the battery 30 is fully mounted in the battery receiving portion 48: (1) portion 71 (see FIG. 3) of
15 the battery housing 31 is preferably in contact with the bottom side of the shelf forming the cavity 77, and (2) the flexible, resilient cantilever members 37 are in engagement with the side surfaces forming the cavity 77 which results in a pinching interference fit that tends to resist transmission of
20 vibration to the contacts 33 or 33A. The pinching interference holds the flanges of the track portions 49 in engagement with the grooves 35 of the battery housing 31 to retain the battery 30 attached to the handgrip 5.

The enlarged distal ends 38 of the flexible, resilient
25 cantilever members 37 have an outward biased radius 28. When the battery 30 is inserted into the receiving portion 48 of the handle portion 6, the outward biased radius 28 contacts the radiused side wall 75 (FIG. 12). The width
30 between the outermost portions of the two distal end outward biased radiuses 28 is greater than the width of the radiused side walls 75. With this difference in widths, the flexible, resilient cantilever members 37 are forced inward
35 when the battery 30 is received in the battery receiving portion 48 thereby generating a resistance to movement. For example, the interference is preferably less than about 0.1 inches and is more preferably less than about 0.02 inches. This slight interference causes the resilient members 37 to
40 deflect and to provide excellent frictional contact with the cavity 77 in the battery receiving portion 48. In the manner described above, the cantilever members 37 stabilize the front end of the battery 30. This is especially effective in resisting movement when using the instrument is used for
oscillating sawing where side to side forces (perpendicular to the axis H) are generated.

45 Preferably, the flexible, resilient cantilever members 37 comprise a single, unitary, integral monolithic piece with the battery housing 31. Thus, the material for the battery housing 31 should be sufficiently durable for forming a battery housing (e.g. it should be able to withstand autoclaving
50 procedures), and yet resiliently flexible to accomplish the repeated interference fit of the flexible, resilient cantilever members 37 and cavity 77. Any suitable materials may be used including the materials discussed above as suitable for use to construct the casing 31. Alternatively, the flexible,
55 resilient cantilever members 37 may be constructed from a material different than the material used to construct the casing 31.

When the drive assembly 10 is held in the position
60 referenced in FIG. 2, the mounting grooves 35 and flanges of the track portions 49 are cooperable to resist the effect of gravity on the device 10 which, in prior art devices, tends to urge the battery away from contact with the rest of the device. A latch 56 is provided for releasably securing the
65 battery 30 to the battery receiving portion 48, and for retaining the electrical contact between contacts 33 of the battery 30 and the battery terminals 39 (or the terminals 39A with the contacts 33A) of the battery receiving portion 48.

The latch 56 comprises a blocking member 57 mounted on the lower portion of the housing 6 for movement between a latched (FIG. 4) and a release position. A coil spring 58 biases the blocking member 57 toward the latched position. The latch 56 also includes the battery housing 31 having surfaces defining slot 34 for receiving a chamfered end 55 of the blocking member 57.

In the latched position, (1) the mounting grooves 35 of the battery 30 are received in the track portions 49 (see FIG. 4) in the battery receiving portion 48, and (2) the chamfered end 55 of the blocking member 57 is biased into engagement with the slot 34 of the battery 30 to lock the battery 30 to the battery receiving portion 48 of the housing. Indicia 59 may be present to provide user information such as how to unlatch the battery 30.

The latch 56 also includes means for automatically moving the blocking member 57 from the latched toward the release position as the battery 30 is mounted to the battery receiving portion 48. That means comprises the battery housing 31 having a ramp surface 36 adapted to engage the chamfered end 55 on the blocking member 57.

Referring to FIG. 2, as the battery 30 is slid into the track portions 49 of the battery receiving portion 48, the ramp surface 36 engages the chamfered end 55 on the blocking member 57 and cams the blocking member 57 toward the release position, thereby enabling the flanges of the track portions 49 to be slid into the corresponding, cooperable grooves 35 of the battery housing 31. Once the battery 30 is fully mounted on the battery receiving portion 48, the chamfered end 55 of the blocking member 57 is biased into engagement with the slot 34 of the battery housing 31 as described above. The side of the blocking member 57 opposite chamfered end 55 is not chamfered to resist inadvertent release of the battery 30.

As a portion of the electrical circuit means mentioned above, the drive assembly 10 also includes a convenient rotary switch means, operated by ribbed member 72 on the proximal end 1 of the drive housing 4 opposite drive member 18, for causing the motor 12 to rotate the drive member 18 either in forward or reverse (clockwise or counterclockwise) directions, or to prevent any rotation by the motor 12 even when the trigger 40 is moved to its inner position. Indicia 73 indicate when the device is in the forward, reverse or stop modes.

FIG. 21 is a schematic illustration of the switch means. The motor control switch with forward, off and reverse positions is preferably mounted behind the motor. The motor control switch includes a rotatable knob 72 with an attached magnet 62 and a detent mechanism 63 with three positions that correspond to the forward, off and reverse positions. When the knob is rotated fully clockwise, the magnet 62 by its magnetic field, activates one of two hall sensors 61 to run the motor counter-clockwise when facing the output shaft. When the knob is rotated fully counter-clockwise, it will reverse the motor. A center, neutral (off) position is also included.

The present invention has now been described with reference to several embodiments thereof. It will be apparent to those skilled in the art that many changes or additions can be made in the embodiments described without departing from the scope of the present invention. Thus, the scope of the present invention should not be limited to the structures described in this application, but only by structures described by the language of the claims and the equivalents of those structures.

What is claimed is:

1. A rechargeable battery adapted to be repeatably and releasably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and a blocking member movable between latched and release positions;

said battery comprising:

an autoclavable battery housing having top and bottom portions, at least one cell within the battery housing and a pair of battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly.

releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion.

said releasable attachment means comprising:

a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
b) a slot for receiving the blocking member when the blocking member is in the latched position.

2. A rechargeable battery according to claim 1 wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and

each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

3. A rechargeable battery according to claim 1 wherein said battery contacts each include a first end fixedly attached to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

4. A rechargeable battery according to claim 1 wherein said battery housing comprises opposite, substantially flat front and rear walls constructed from a material suitable for protecting the cell(s) during an autoclave procedure.

said battery comprises eight substantially cylindrical cells having longitudinal axes, said eight cylindrical cells being arranged in:

a) a front row of three cells substantially adjacent said front wall within the battery housing,
b) a rear row of three cells substantially adjacent said rear wall within the battery housing, and
c) a middle row of two cells between said front and rear rows wherein all eight cells are within the battery housing.

5. A rechargeable battery according to claim 1 wherein the slot is sized and shaped to engage the blocking member to lock the battery to the battery receiving portion when the blocking member is in the latched position.

6. A rechargeable battery according to claim 1 wherein the battery further includes means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

7. A rechargeable battery according to claim 6 wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

8. A rechargeable battery adapted to be repeatably and releasably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and a blocking member movable between latched and release positions;

said battery comprising a battery housing having top and bottom portions, at least one cell within the battery

housing, and a pair of battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly when the battery is fully received by the orthopedic drive assembly.

releasable attachment means for releasably attaching the battery to the battery receiving portion, said releasable attachment means comprising:

- a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
- b) a slot for receiving the blocking member when the blocking member is in the latched position, wherein the slot is sized and shaped to engage the blocking member to lock the battery to the battery receiving portion when the blocking member is in the latched position.

9. A rechargeable battery according to claim 8 wherein the battery further includes means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

10. A rechargeable battery according to claim 9 wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

5 11. A rechargeable battery according to claim 8 wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and

10 each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

12. A rechargeable battery according to claim 8 wherein said battery contacts each include a first end fixedly attached
15 to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

* * * * *

REISSUE PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James F. Pitzen et al. Examiner:
Patent No.: 5,792,573 Group Art Unit: 1111
Assignee: Linvatec Corporation
Filed: July 24, 1996 Docket No.: 5809.263-US-RE
Title: RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO
ORTHOPEDIC DEVICE

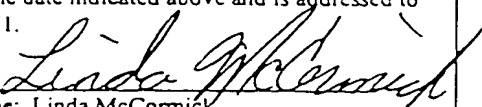
CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL488196274US

Date of Deposit: 11 August 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By:


Name: Linda McCormick

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Box Reissue
Washington, D.C. 20231

Dear Sir:

For the above-noted reissue application filed herewith, please amend the application as follows.

In the Claims

Please add new claims 13-35 as follows:

13. A rechargeable battery adapted to be repeatably and releasably attached to a drive assembly, the drive assembly having battery terminals and a battery receiving portion; said battery comprising:

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a battery housing having top and bottom portions, at least one cell within the battery housing and battery contacts adjacent the housing and situated to engage the battery terminals of the drive assembly;
one of the drive assembly and the battery having a pair of tracks defining flanges; and
the other of the drive assembly and the battery having grooves configured to receive the flanges of the tracks;
wherein the battery may be repeatably and releasably attached to the drive assembly by sliding the battery into and out of engagement with the drive assembly.

14. A rechargeable battery according to claim 13, wherein the drive assembly further includes a blocking member movable between a latched and release position.

15. A rechargeable battery according to claim 14, wherein said battery further comprises:
a) a slot for receiving the blocking member when the blocking member is in the latched position.

16. A rechargeable battery according to claim 15, wherein the slot is sized and shaped to engage the blocking member to lock the battery to the battery receiving portion when the blocking member is in the latched position.

17. A rechargeable battery according to claim 14, wherein said battery further comprises means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

18. A rechargeable battery according to claim 17, wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

19. A rechargeable battery according to claim 13, wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and

each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

20. A rechargeable battery according to claim 13, wherein said battery contacts each include a first end fixedly attached to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

21. A rechargeable battery adapted to be repeatably and releaseably attached to a drive assembly, the drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, and battery terminals;

said battery comprising:

a battery housing having top and bottom portions, at least one cell within the battery housing and battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the drive assembly, and
releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion.

22. A rechargeable battery according to claim 21, wherein the drive assembly further includes a blocking member movable between a latched and release position.

23. A rechargeable battery according to claim 22, wherein said releasable attachment means comprises:

- a) the battery having a pair of grooves adapted to receive the flanges of the tracks,
and
- b) a slot for receiving the blocking member when the blocking member is in the latched position.

24. A rechargeable battery according to claim 23, wherein the slot is sized and shaped to engage the blocking member to lock the battery to the battery receiving portion when the blocking member is in the latched position.

25. A rechargeable battery according to claim 22, wherein the battery further includes means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

26. A rechargeable battery according to claim 25, wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

27. A rechargeable battery according to claim 21, wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

28. A rechargeable battery according to claim 21, wherein said battery contacts each include a first end fixedly attached to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

29. A rechargeable battery adapted to be repeatably and releaseably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, and battery terminals; said battery comprising:

a battery housing having top and bottom portions, at least one cell within the battery housing and battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly, and

releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion.

30. A rechargeable battery according to claim 29, wherein the drive assembly further includes a blocking member movable between a latched and release position.

31. A rechargeable battery according to claim 30, wherein said battery further comprises means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

32. A rechargeable battery according to claim 33, wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

33. A rechargeable battery according to claim 29, wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

34. A rechargeable battery according to claim 29, wherein said battery contacts each include a first end fixedly attached to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

35. A rechargeable battery according to claim 29, wherein said battery housing comprises opposite, substantially flat front and rear walls constructed from a material suitable for protecting the cell(s) during an autoclave procedure,

said battery comprises eight substantially cylindrical cells having longitudinal axes, said eight cylindrical cells being arranged in:

- a) a front row of three cells substantially adjacent said front wall within the battery housing.
- b) a rear row of three cells substantially adjacent said rear wall within the battery housing. and
- c) a middle row of two cells between said front and rear rows wherein all eight cells are within the battery housing.

Conclusion

Original claims 1-12 of U.S. Patent No. 5,792,573 are pending. New broadening claims 13-35 have been added. Accordingly, claims 1-35 are now pending. The Examiner is invited to contact the Applicants' representative at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully Submitted,

MERCHANT & GOULD P.C.
P.O. Box 2903
Minneapolis, MN 55402-0903
(612) 382-5300

Date: 11 August 2000

By: _____

Bryan K. Phillips
Reg. No. P-46,990

REISSUE PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James F. Pitzen et al. Examiner:
Patent No.: 5,792,573 Group Art Unit: 1111
Assignee: Linvatec Corporation
Filed: July 24, 1996 Docket No.: 5809.263-US-RE
Title: RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO
ORTHOPEDIC DEVICE

CERTIFICATE UNDER 37 CFR 1.10

Express Mail mailing label number: EL488196274US

Date of Deposit: 11 August 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service Express Mail Post Office To Addressee service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By: *Linda McCormick*
Name: Linda McCormick

CERTIFICATE UNDER 37 C.F.R. § 3.73(b) and
CONSENT BY ASSIGNEE UNDER 37 C.F.R. §1.172

Assistant Commissioner for Patents
Box Reissue
Washington, D.C. 20231

Linvatec Corporation ("Linvatec"), a corporation organized and existing under and by virtue of the laws of the State of Florida, and having an office and place of business at 11311 Concept Blvd, Largo, Florida, 33773, certifies that it is the assignee of the entire right, title and interest in the patent identified above by virtue of an agreement between Linvatec and the original assignee, Minnesota Mining And Manufacturing Company, a corporation organized and existing under and by virtue of the laws of Delaware. The original assignment executed by the Inventors of the above-identified patent in favor of Minnesota Mining And Manufacturing was recorded at Reel 7042, Frame 560. Pursuant to 37 C.F.R. §3.73(b), a copy of the relevant portions of the agreement establishing Linvatec's ownership in the patent identified above is attached hereto.

The Assignee, Linvatec, hereby consents to the accompanying application for reissue of U.S. Patent No. 5,792,573.

The undersigned has reviewed all the documents in the chain of title of the patent application identified above and, to the best of undersigned's knowledge and belief, title is in the assignee identified above.

The undersigned (whose title is supplied below) is empowered to sign this statement on behalf of the assignee.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Please direct all correspondence in this application to:

Bryan K. Phillips:
Merchant & Gould P.C.
P.O. Box 2903
Minneapolis, MN 55402-0903
(612) 332-5300

Dated: 11 August 2000

By: Gene Warzecha
Gene Warzecha
Assistant Secretary
Linvatec Corporation

ASSET PURCHASE AGREEMENT

THIS ASSET PURCHASE AGREEMENT (this "Agreement") is made and entered into as of this 29th day of June, 1999 by and between Linvatec Corporation, a Florida corporation (the "Buyer"), and Minnesota Mining and Manufacturing Company, a Delaware corporation ("3M").

WHEREAS, 3M, through its Medical Surgical Division (the "Division"), engages in the business of manufacturing and selling a broad range of surgical powered instrument products excluding those instruments that formed any portions of 3M's cardiovascular perfusion business, its orthopedic devices business, metal implant business and carpal tunnel release businesses, (the manufacture and sale of such products through such Division being herein called the "Business");

WHEREAS, 3M now desires to exit the Business without interrupting the availability of products and customer support and Buyer desires to purchase and acquire the assets of the Business, all on the terms and conditions set forth in this Agreement;

WHEREAS, Buyer wishes to purchase all assets used in or necessary to the Business, and to hire or otherwise retain the services of certain 3M employees or agents necessary to or used in the Business subject to the terms set forth herein;

WHEREAS, Buyer wishes to purchase the Business in a manner that causes as little disruption as possible to customers of and the profitability of the Business; and

WHEREAS, 3M now desires to sell and the Buyer desires to purchase and acquire certain assets of the Business, all on the terms and conditions set forth in this Agreement.

NOW, THEREFORE, in consideration of the mutual covenants and agreements contained herein, the parties agree as follows:

ARTICLE I

Definitions

1.01 Purchased Assets. The term "Purchased Assets" or any variation thereof as used in this Agreement shall mean the assets required to be sold, assigned, transferred and conveyed by 3M to the Buyer pursuant to Article II hereof.

1.02 3M Products. The term "3M Products" or "3M Product Line" or any variation thereof as used in this Agreement shall mean those 3M products manufactured or sold through the Division described in the attached Schedule 1.02.

1.03 Assumed Liabilities. The term "Assumed Liabilities" or any variation thereof as used in this Agreement shall mean the liabilities and obligations required to be assumed by the Buyer pursuant to Article IV hereof.

1.04 Purchased Intellectual Property. The term "Purchased Intellectual Property" means patents, patent applications, utility model registrations, design patents, registered or unregistered trademarks, trade secrets and know-how owned by 3M on the Closing Date that directly and solely relate to the Business as conducted on the Closing Date, with such products being listed in Schedule 1.04, but excluding components and materials supplied to the Business by other businesses of 3M.

1.05 Licensed Intellectual Property. The term "Licensed Intellectual Property" means patents, patent applications, utility model registrations, design patents, trade secrets and know-how owned by 3M on the Closing Date that are used directly in both the Business as conducted on the Closing Date and 3M's electronic products and/or orthopedic casting business, but excluding Components and Materials supplied to the Business by other businesses of 3M.

1.06 IP Agreements. The term "IP Agreements" means those agreements licensing patents to or from 3M that directly and solely relate to the Business as conducted on the Closing Date and are listed in Schedule 1.06, excluding however supplier, distribution, consulting and confidentiality agreements.

1.07 Sublicensed IP Agreement. The term "Sublicensed IP Agreement" means the Automotive Supplier Agreement dated 22nd September 1998 between the Lemelson Medical, Education and Research Foundation, Limited Partnership and 3M.

1.08 Adverse Material Change. The term "Adverse Material Change" shall mean any change that affects the valuation of the Business in a manner that a reasonable buyer, familiar with trends likely to affect the Business, would consider such change in valuing the Business.

ARTICLE II

Sale of Assets

2.01 Purchased Assets. Subject to the terms and conditions hereof, 3M agrees to sell, assign, transfer and convey to the Buyer, and the Buyer agrees to purchase and acquire from 3M, at the Closing (as hereinafter defined) on the Closing Date (as hereinafter defined), all of 3M's right, title and interest, if any, immediately prior to the effective time of the Closing in and to the following assets wherever located:

- (a) The fixed assets, machinery, manufacturing equipment, laboratory and test equipment and 3M Product specifications, drawings and manufacturing processes documents and

office equipment used in the Business, including those assets specified, on and offsite, in Schedule 2.01(a).

(b) Raw material, packaging, factory supplies, work in progress and finished goods inventories to the extent related to the 3M Product Line, in an amount consistent with past practices of the Business.

(c) Purchased Intellectual Property as provided in Article VI.

(d) Records to the extent substantially related to the 3M Product Line and the Purchased Assets.

(e) Purchase orders to the extent substantially related to the 3M Product Line, the Purchased Assets or the Business issued by or to 3M in the ordinary course of business.

(f) Subject to Section VI, leases, contracts, agreements and commitments to the extent substantially related to the 3M Product Line, the Purchased Assets or the Business, to the extent assignable and/or transferable.

(g) All registrations, licenses, permits or any other government authorizations relating to the 3M Product Line to the extent transferable, subject to Article VI.

(h) All demonstration units or loaner units relating to the 3M Product Line, including those listed on Schedule 2.01(h).

2.02 Excluded Assets. It is understood and agreed that the following assets of the Business are excluded from Purchased Assets: (i) cash; (ii) accounts receivable; (iii) any items listed in Schedule 2.02 (Excluded Assets); and (iv) excluded intellectual property assets set forth in Section 6.10.

2.03 Retention of Certain Records. It is understood and agreed that 3M reserves the right to retain copies or written records of the items referred to in Sections 2.01(c) and (d) for the purpose of defending any claims, losses, causes of action or lawsuits, including those related to the sale of the 3M Product Line by 3M, and for the purpose of preparing any tax returns or financial statements or reports, provided that 3M shall maintain the confidentiality of such documents and shall promptly notify the Buyer of any lawsuit or claim served upon 3M relating to the Business and/or records or documents.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed
as of the day and year first above written.

MINNESOTA MINING AND
MANUFACTURING COMPANY

By: [Signature]
Its: Division Vice President

LINVATEC CORPORATION

By: [Signature]
Its: President

Acq. Magnum Agreement M.doc

L:\mPower\Instruments\WPA\Draw2.CONMED.doc

Schedule 1.04¹

Patents

Country	Application or Serial No.	Patent or Publication No.	Title	First Inventor
AU	52901/86	574580	Bone Stapler Cartridge	Mongeon, Douglas R.
CA	452165	1225307	Orbital Saw Blade	Mongeon, Douglas R.
CA	457516	1237353	Bone Stapler	Bent, John H.
CA	454652	1229769	Bone Stapler	Assell, Robert L.
CA	454653	1224991	Bone Stapler	Skwor, Edward P.
CA	500358	1246411	Bone Stapler Cartridge	Mongeon, Douglas R.
CA	523525	1258799	Bone Stapler	Mongeon, Douglas R.
CH	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
DE	84.304356.3	130784	Bone Stapler	Bent, John H.
DE	86.309533.7	228834	Bone Stapler	Mongeon, Douglas R.
DE	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
DE	87.302789.0	240310	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
DE	08/258,338	29509191.6	Orthopedic Surgical Device	Pitzen, James F.
DK	724/86		Bone Stapler Cartridge	Mongeon, Douglas R.
EP	84.304356.3	130784	Bone Stapler	Bent, John H.
EP	86.309533.7	228834	Bone Stapler	Mongeon, Douglas R.
EP	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
EP	87.302789.0	240310	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
EP	97.902011.2		Sterilizable Battery Enclosure	Klinzing, William P.
EP	97.927779.5		Powered Surgical Instruments and Control Unit	Pitzen, James F.
ES	551908	551908	Bone Stapler Cartridge	Mongeon, Douglas R.
FR	84.304356.3	130784	Bone Stapler	Bent, John H.
FR	86.309533.7	228834	Bone Stapler	Mongeon, Douglas R.
FR	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
FR	87.302789.0	240310	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
HK		451/1992	Bone Stapler	Bent, John H.
HK		285/93	Bone Stapler Cartridge	Mongeon, Douglas R.
HK		644/95	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
IT	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
JP	124993/84	1764910	Bone Stapler	Bent, John H.
JP	29164/86	1902354	Bone Stapler Cartridge	Mongeon, Douglas R.
JP	290658/86	1985603	Bone Stapler	Mongeon, Douglas R.
JP	08/258,388	3018959	Orthopedic Surgical Device	Pitzen, James F.
JP	507886/98		Sterilizable Battery Enclosure	Klinzing, William P.
JP			Powered Surgical Instruments and Control Unit	Pitzen, James F.
NL	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
SE	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.

Schedule 1.04

Patents

Country	Application or Serial No.	Patent or Publication No.	Title	First Inventor
UK	86.308533.7	228834	Bone Stapler	Mongeon, Douglas R.
UK	86.300985.8	192418	Bone Stapler Cartridge	Mongeon, Douglas R.
UK	87.302789.0	240310	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
US	06/303,553	4,386,609	Attaching Assembly For An Osteotomy Saw Blade	Mongeon, Douglas R.
US	06/275,896	4,414,867	Internal Fixation Of Bone, Tendon And Ligaments	Shapiro, Jules S.
US	06/492,042	4,819,334	Orbital Saw Blade	Mongeon, Douglas R.
US	08/508,588	4,540,110	Bone Stapler	Bent, John H.
US	06/514,928	4,527,726	Bone Stapler	Assell, Robert L.
US	06/514,929	4,500,025	Bone Stapler	Skwor, Edward P.
US	07/157,439	RE 33,382	Bone Stapler Cartridge	Mongeon, Douglas R.
US	06/806,759	4,648,541	Bone Stapler	Mongeon, Douglas R.
US	06/701,970	4,569,469	Bone Stapler Cartridge	Mongeon, Douglas R.
US	07/118,056	4,834,092	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
US	08/847,483	4,736,742	Device For Driving Tools In Orthopedic Surgery	Alexson, Charles E.
US	08/830,674	4,728,876	Orthopedic Drive Assembly	Mongeon, Douglas R.
US	07/185,058	4,901,712	Bone Nailer	Voegeli, Douglas W.
US	07/295,254	4,872,452	Bone Rasp	Alexson, Charles E.
US	07/568,602	5,080,983	Battery	Alexson, Charles E.
US	08/692,886	5,792,573	Rechargeable Battery Adapted To Be Attached To Orthopedic Device	Pitzen, James F.
US	08/258,338	5,553,675	Orthopedic Surgical Device	Pitzen, James F.
US	D-29/048,265	D379795	Battery Housing For Orthopedic Surgical Device	Pitzen, James F.
US	08/576,470	5,697,158	Orthopedic Surgical Device Having A Rotatable Portion And Lock	Klinzing, William P.
US	D-29/024,421	D-384463	Orthopedic Surgical Instrument	Pitzen, James F.
US	08/583,659	5,575,054	Bone Stapler Cartridge	Klinzing, William P.
US	08/319,293	5,540,374	Bone Stapler Cartridge	Klinzing, William P.
US	08/693,917		Sterilizable Battery Enclosure	Klinzing, William P.
US	08/723,800		Powered Surgical Instruments and Control Unit	Pitzen, James F.
WO	US97/00525	WO98/06144	Sterilizable Battery Enclosure	Klinzing, William P.
WO	US97/08997	WO98/14129	Powered Surgical Instruments and Control Unit	Pitzen, James F.

REISSUE PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James F. Pitzen et al. Examiner:
Patent No.: 5,792,573 Group Art Unit: 1111
Assignee: Linvatec Corporation
Filed: July 24, 1996 Docket No.: 5809.263-US-RE
Title: RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO
ORTHOPEDIC DEVICE

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL488196274US

Date of Deposit: 11 August 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to Box 7, Assistant Commissioner for Patents, Washington, D.C. 20231.

By: 

Name: Linda McCormick

REQUEST FOR TRANSFER OF DRAWINGS FROM
ORIGINAL PATENT TO REISSUE APPLICATION

Assistant Commissioner for Patents
Box Reissue
Washington, D.C. 20231

Dear Sir:

Please transfer the drawings from original patent, U.S. Patent No. 5,792,573, for the invention entitled "RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO ORTHOPEDIC DEVICE," granted to Pitzen et al. on August 11, 1998, to the reissue application, the specification of which is attached hereto. No changes whatsoever have been made to the

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OFFICE OF PETITIONS

drawings. A copy of the printed drawings of the patent is submitted herewith in accordance with 37 C.F.R. § 1.174.

Respectfully submitted,

MERCHANT & GOULD P.C.
P.O. Box 2903
Minneapolis, MN 55402-0903
(612) 332-5300

Date: 11 August 2000

By: 

Bryan K. Phillips
Reg. No. P-46,990

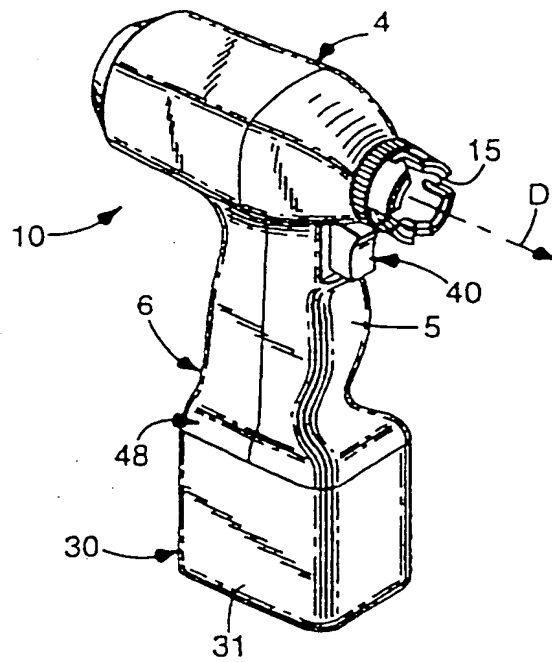


Fig. 1

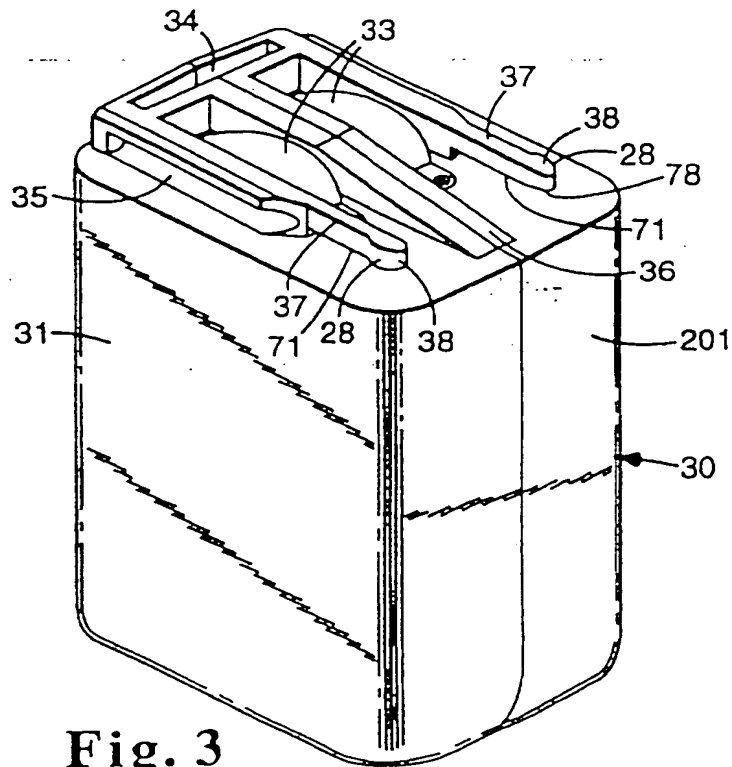
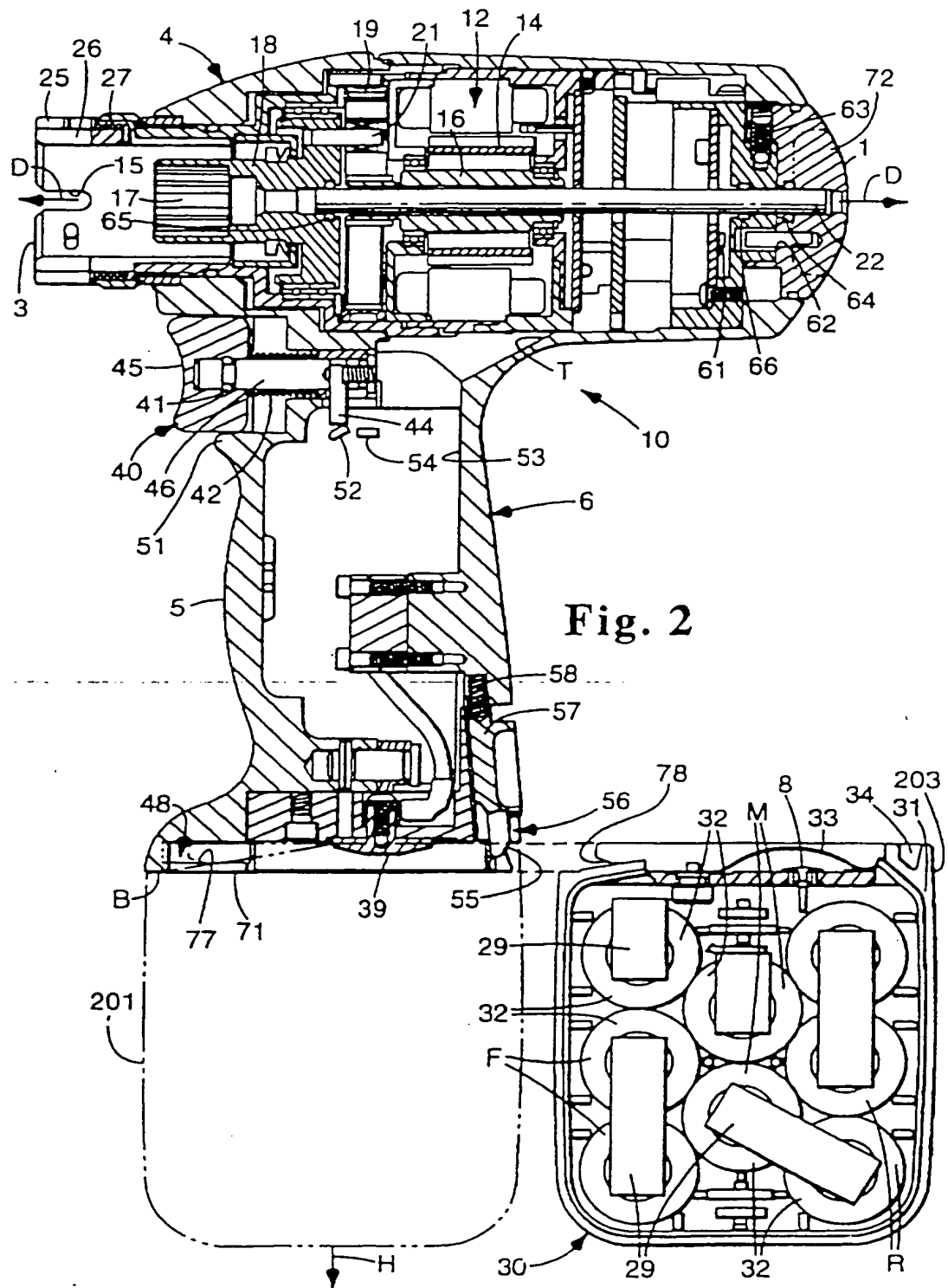


Fig. 3



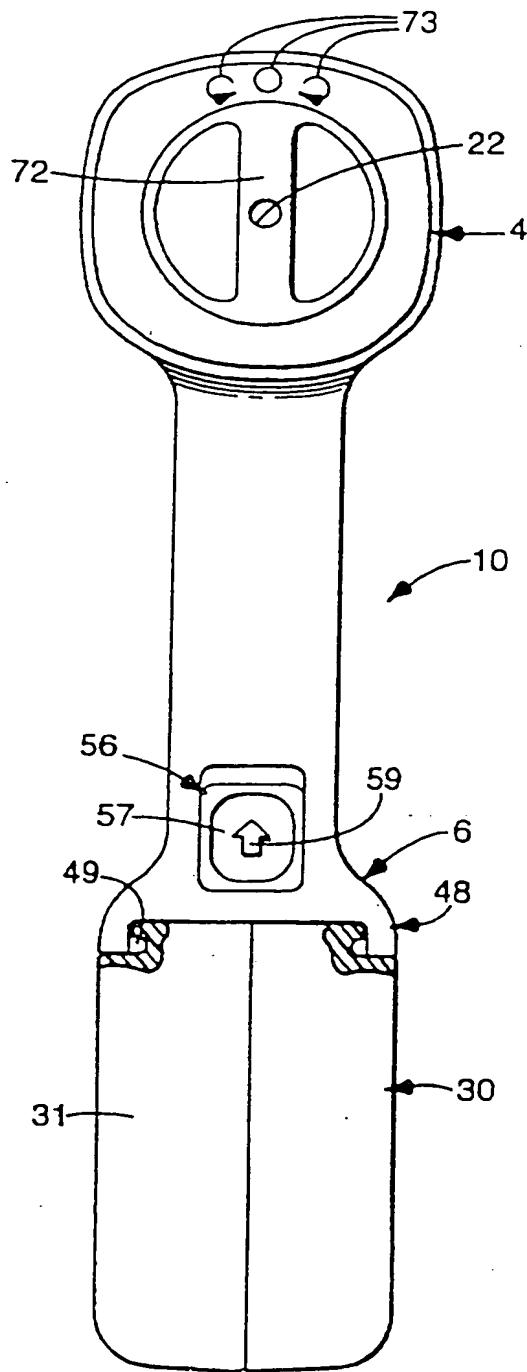


Fig. 4

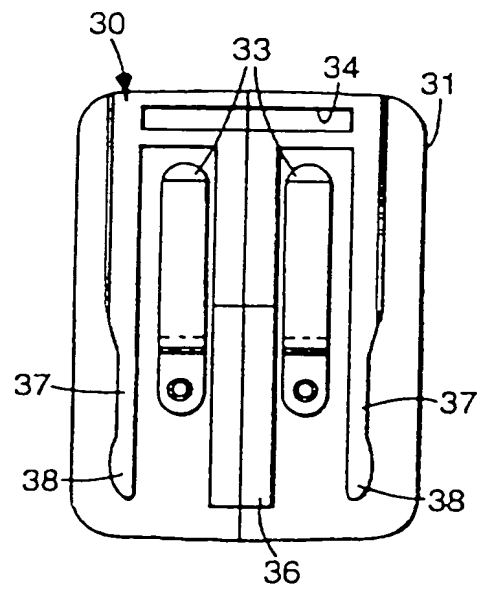


Fig. 5

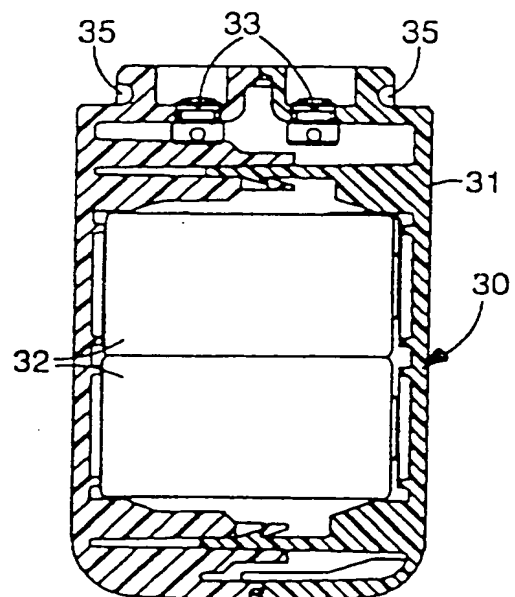


Fig. 6

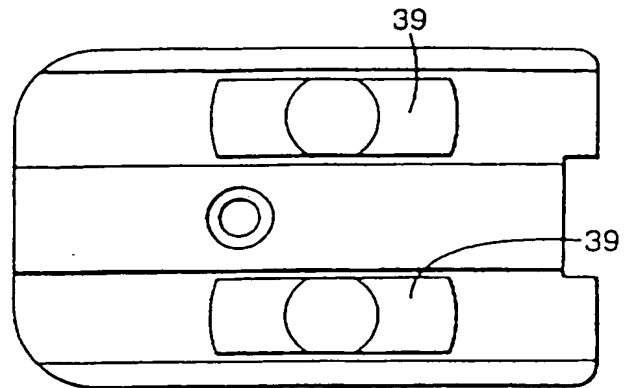


Fig. 6A

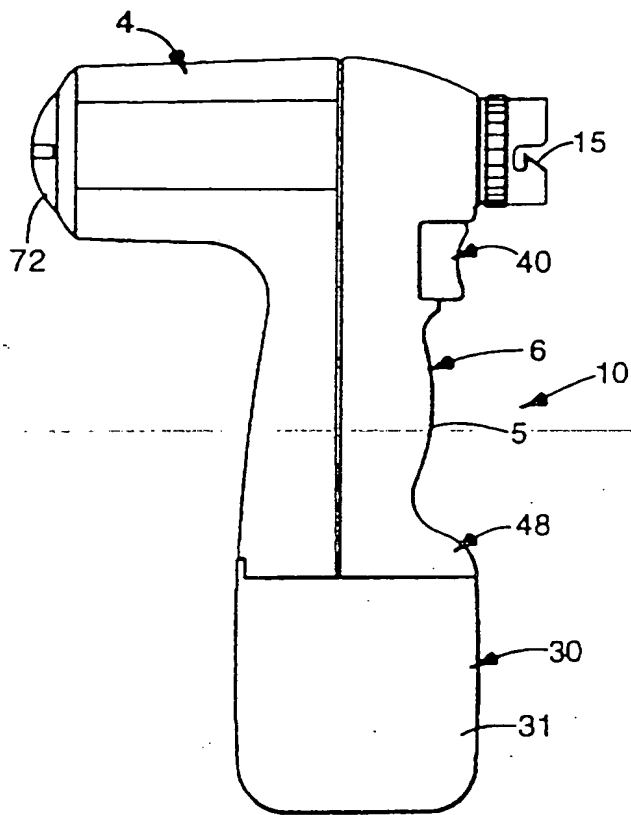


Fig.7

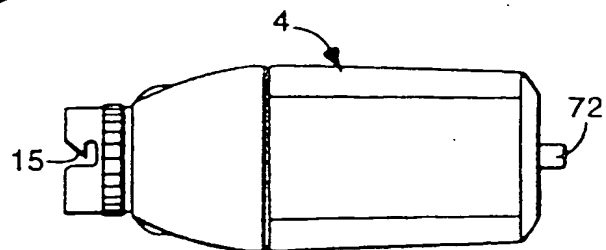


Fig.8

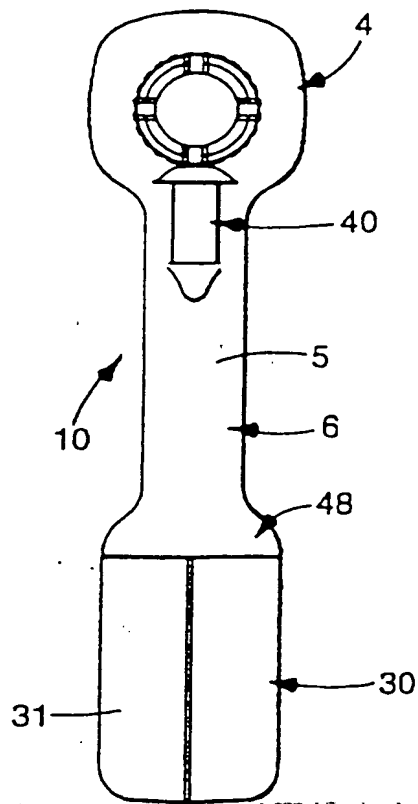


Fig. 9

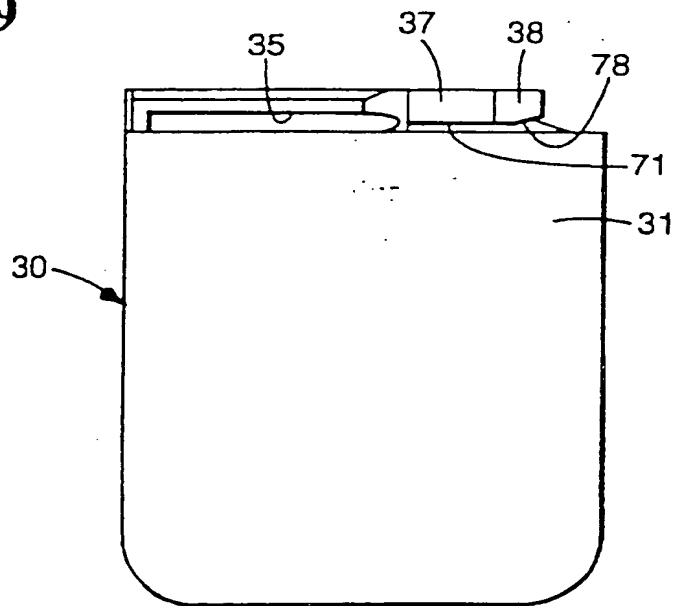


Fig. 10

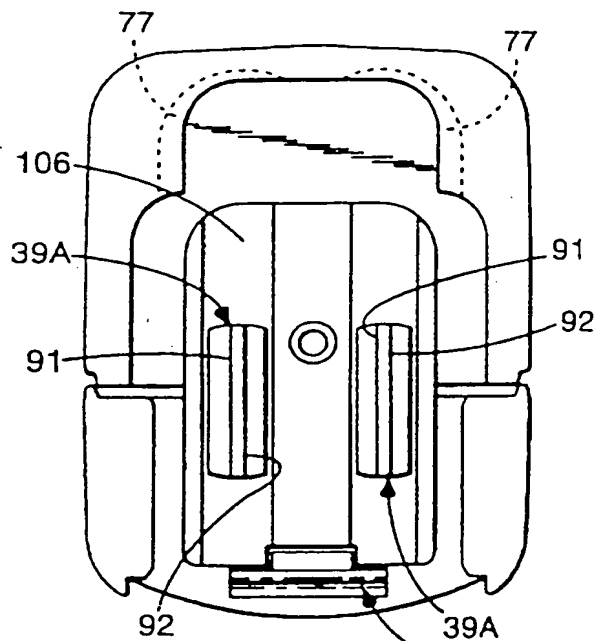


Fig. 11

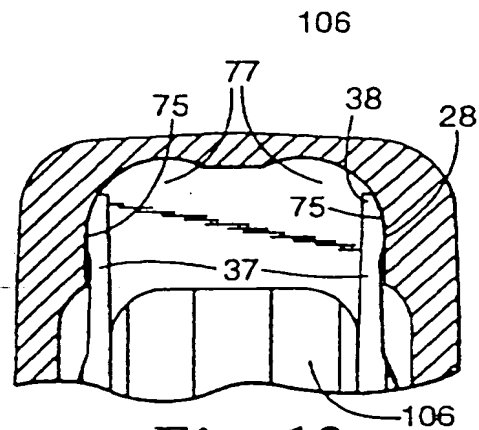


Fig. 12

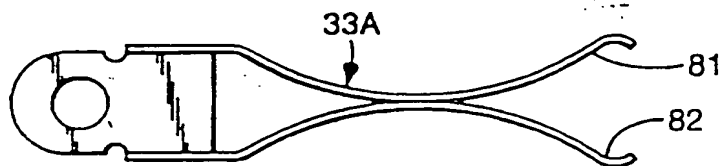


Fig. 13

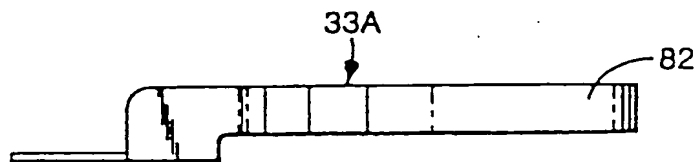


Fig. 14

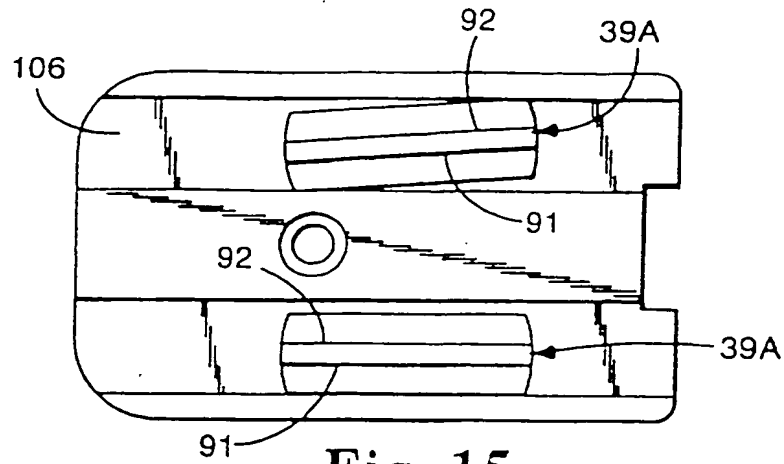


Fig. 15

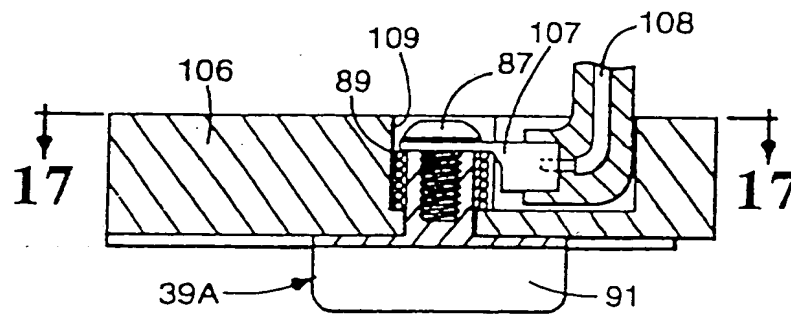


Fig. 16

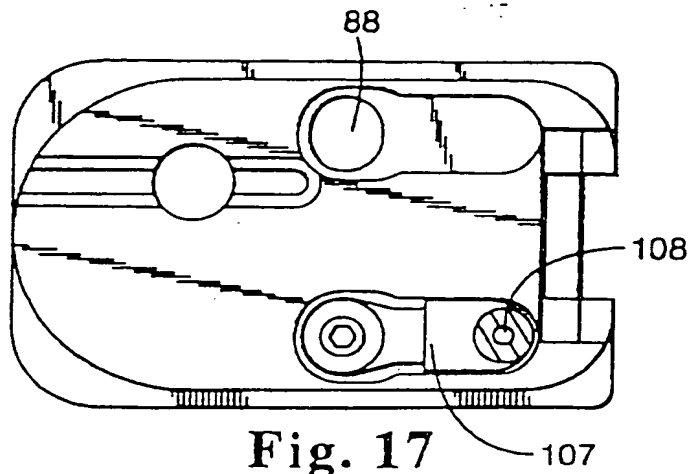


Fig. 17

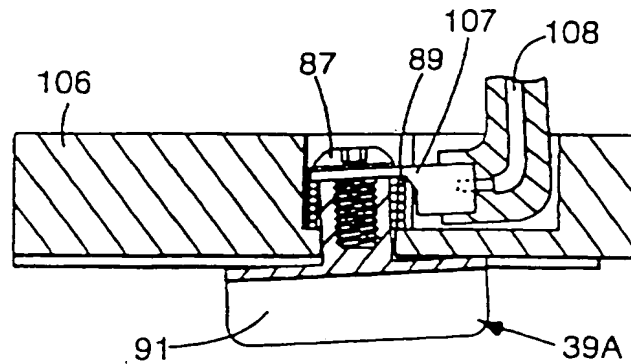


Fig. 18

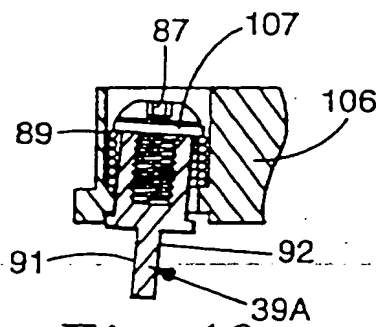


Fig. 19

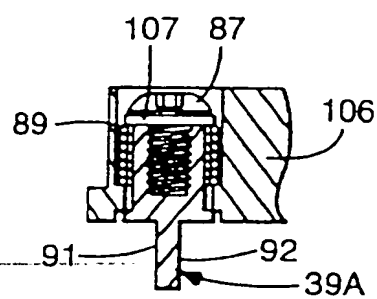


Fig. 20

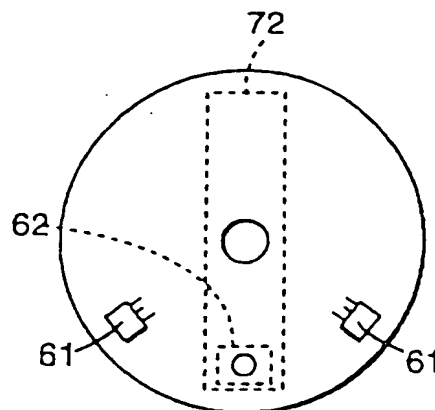


Fig. 21

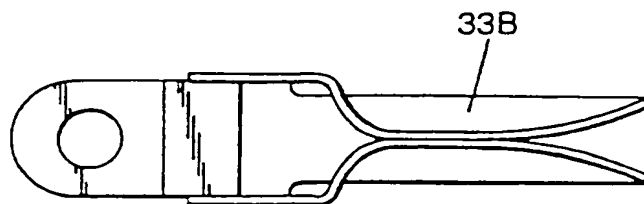


Fig. 22



Fig. 23

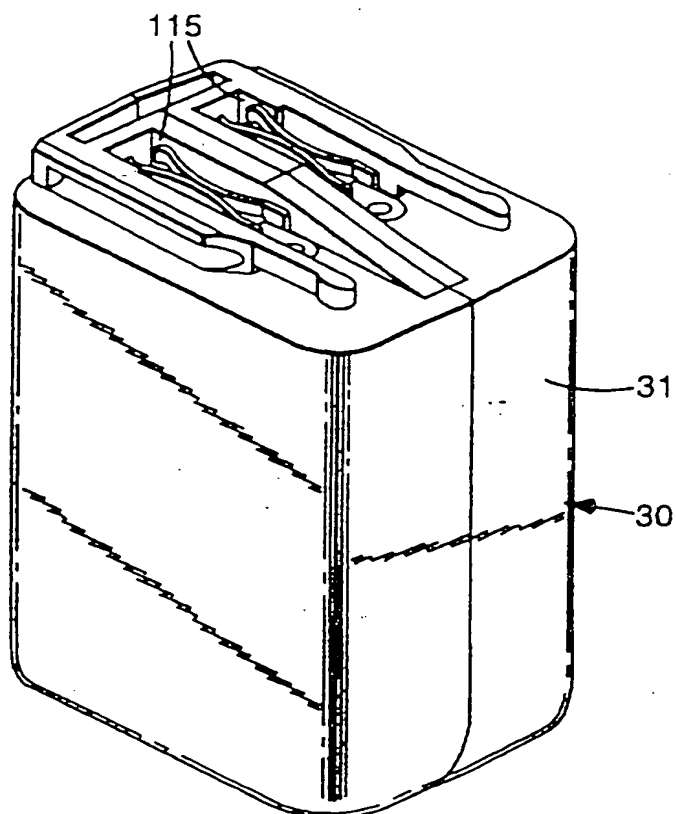


Fig. 24

REISSUE PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: James F. Pitzen et al. Examiner:
Patent No.: 5,792,573 Group Art Unit: 1111
Assignee: Linvatec Corporation
Filed: July 24, 1996 Docket No.: 5809.263-US-RE
Title: RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO
ORTHOPEDIC DEVICE

CERTIFICATE UNDER 37 CFR 1.10

Express Mail[®] mailing label number: EL488196274US

Date of Deposit: 11 August 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service Express Mail Post Office To Addressee[®] service under 37 CFR 1.10 on the date indicated above and is addressed to Box 7, Assistant Commissioner for Patents, Washington, D.C. 20231.

By: *Linda McCormick*

Name: Linda McCormick

OFFER TO SURRENDER U.S. PATENT NO. 5,792,573
UNDER 37 C.F.R. § 1.178

Assistant Commissioner for Patents
Box Reissue
Washington, D.C. 20231

Dear Sir:

The Applicants of the accompanying application for the reissue of Letters Patent for U.S. Patent No. 5,792,573, entitled "RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO ORTHOPEDIC DEVICE," granted to Pitzen et al. on August 11, 1998, hereby offer to surrender said Letters Patent, or if the original is lost or inaccessible, an affidavit to such fact will be submitted before allowance of the above-identified application for reissue. A copy of the issued U.S. Patent No. 5,792,573 is submitted herewith. The offer to surrender is on behalf of

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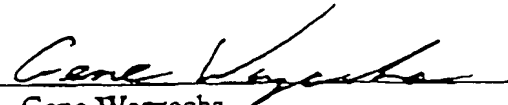
OFFICE OF PETITIONS

Linvatec Corporation, the assignee of all rights, title and interest in U.S. Patent No. 5,792,573,
who assents to this reissue application, as set forth in the accompanying Certificate Under 37
C.F.R. § 3.73(b) and Consent By Assignee Under 37 C.F.R. §1.172.

Respectfully submitted,

Dated: 11 August 2000

By:


Gene Warzecha
Assistant Secretary
Linvatec Corporation



US005792573A

United States Patent [19]

Pitzen et al.

(11) Patent Number: 5,792,573

(45) Date of Patent: Aug. 11, 1998

[54] RECHARGEABLE BATTERY ADAPTED TO
BE ATTACHED TO ORTHOPEDIC DEVICE[76] Inventors: James F. Pitzen; Jeffrey D. Smith;
Charles E. Alexson, all of P.O. Box
33427, St. Paul, Minn. 55133-3427

[21] Appl. No.: 692,886

[22] Filed: Jul. 24, 1996

Related U.S. Application Data

[62] Division of Ser. No. 258,338, Jan. 10, 1994, Pat. No.
5,553,675.[51] Int. Cl.⁶ H01M 2/10

[52] U.S. Cl. 429/97; 429/98; 429/99

[58] Field of Search 429/96-100; 30/500.
30/DIG. 1; 206/703, 705; 310/50; 318/139

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 3 317 398 10/1985 Germany

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Date).Product brochure entitled: "The K-100 Mini-Driver Sys-
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Division (5 pages). (No Date).Product brochure entitled: "Cordless 800 Wire Driver", by
Dyonics, 1984. (2 pages). (No Month).Product brochure entitled: "Cordless 200 Reamer", by
Dyonics, 1984. (2 pages). (No Month).Product brochure entitled: "Cordless 450 Orthopaedic
Drill", by Dyonics, 1984. (2 pages). (No Month).Product brochure entitled: "Mini-Driver™ Air Instrument
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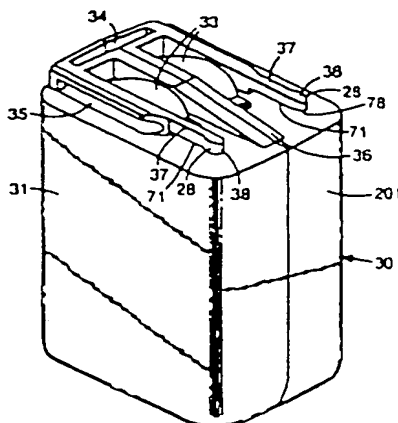
Primary Examiner—Anthony Skapars

Attorney, Agent, or Firm—Gary L. Griswold; Walter F.
Kirk; Jeffrey J. Hohenshell

[57] ABSTRACT

A cordless drive assembly for driving various orthopedic
surgical instruments is described. The drive assembly is
battery powered and includes tracks in the handle portion of
its housing for receiving the battery. A latch locks the battery
to the housing.

12 Claims, 9 Drawing Sheets



OTHER PUBLICATIONS

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Product brochure entitled: "Cordless Sagittal Saw", by Dyonics. 1984. (2 pages). (No Month).

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Product brochure entitled: "System 2000 Battery Powered Instruments", by Stryker®. 1993 (18 pages). (No Month).

Product brochure entitled: "System 2000 Battery Powered Instruments", by Stryker® (11 pages). (No Date).

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Product brochure entitled: "Maxion™ Cordless Powered Instrument System. Assembly, Operation and Maintenance", by 3M HealthCare (6 ges). (No Date).

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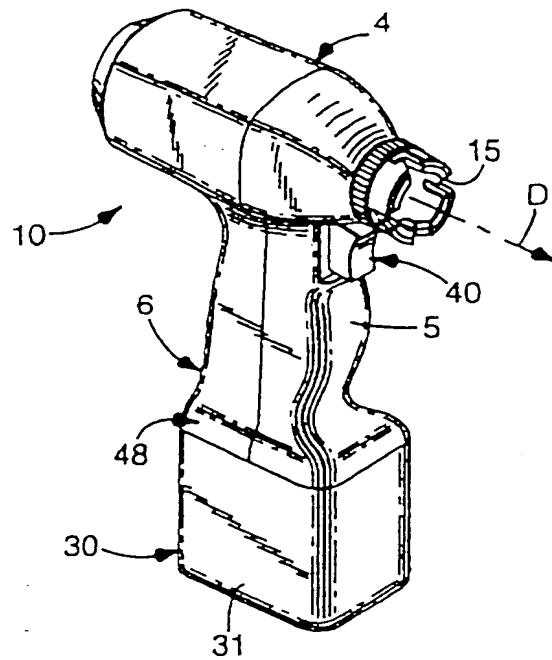


Fig. 1

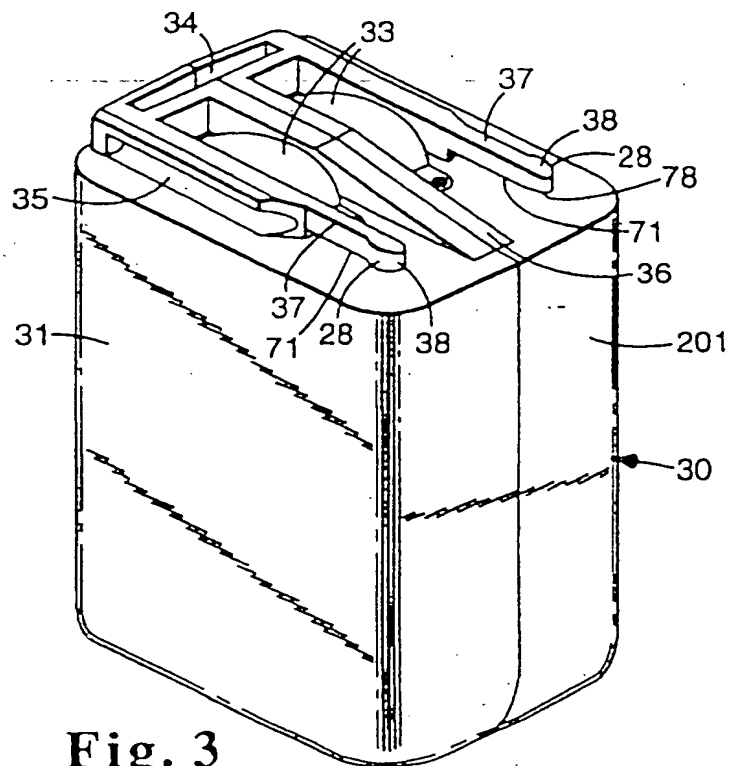
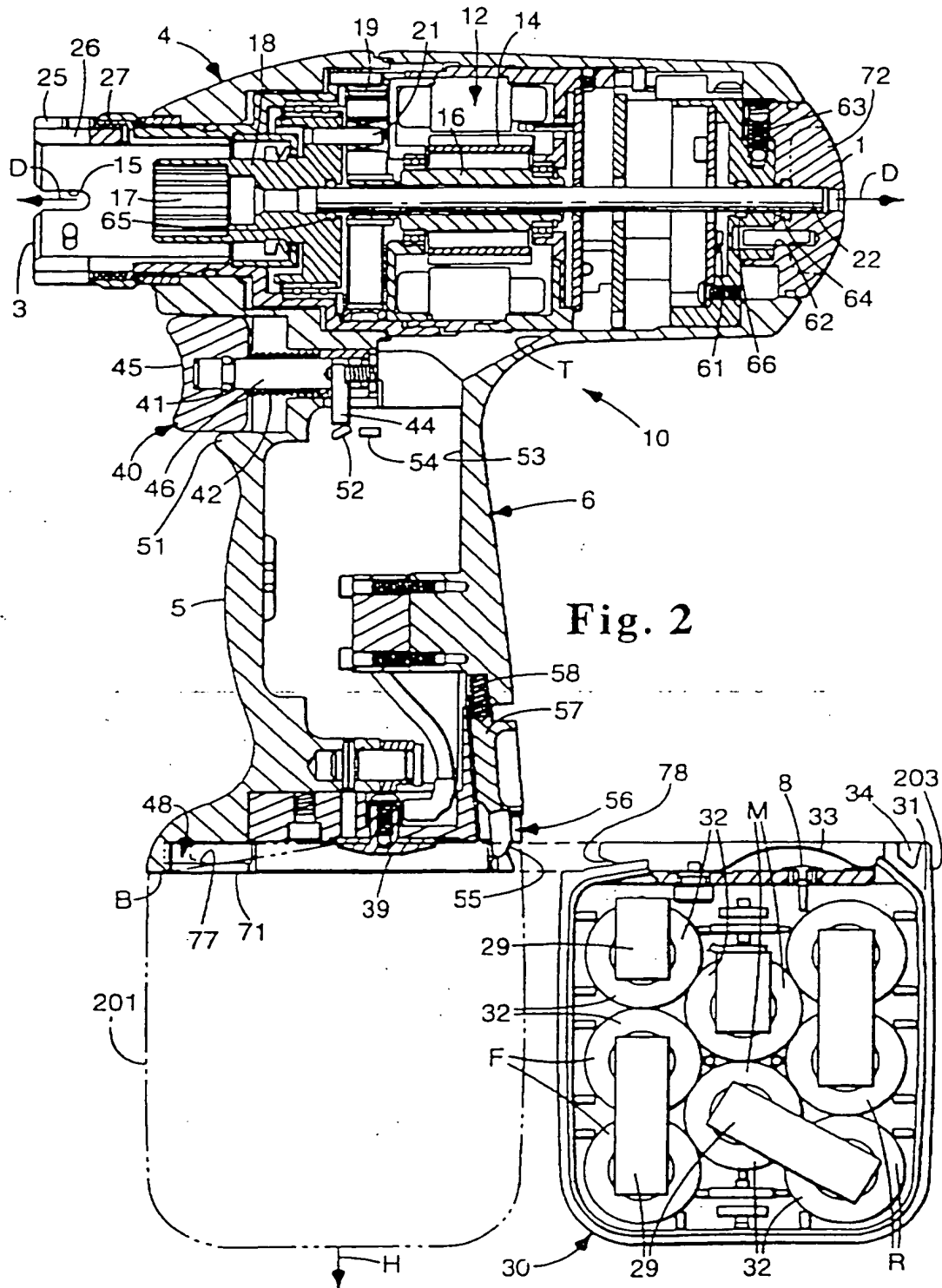


Fig. 3



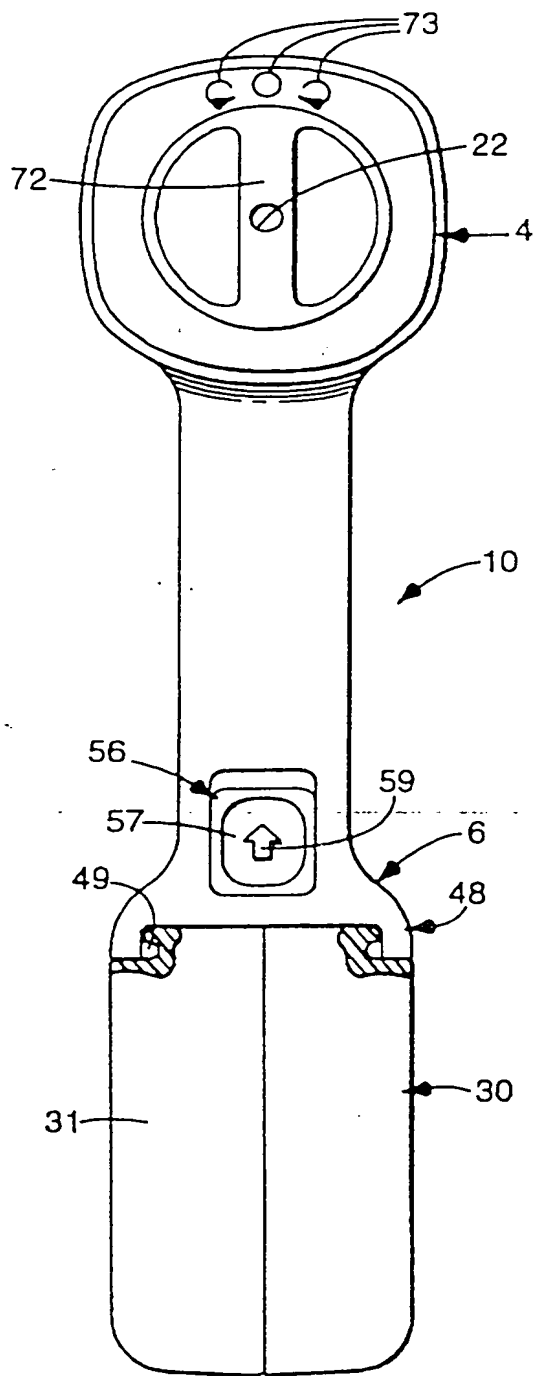


Fig. 4

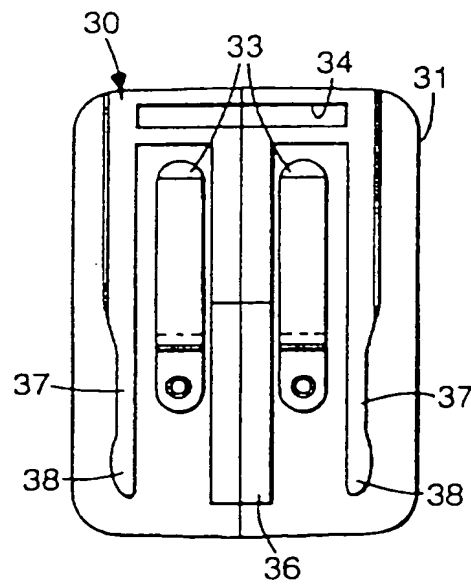


Fig. 5

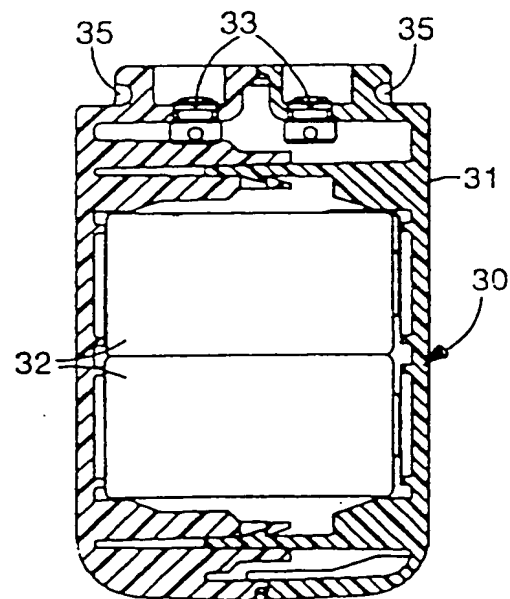


Fig. 6

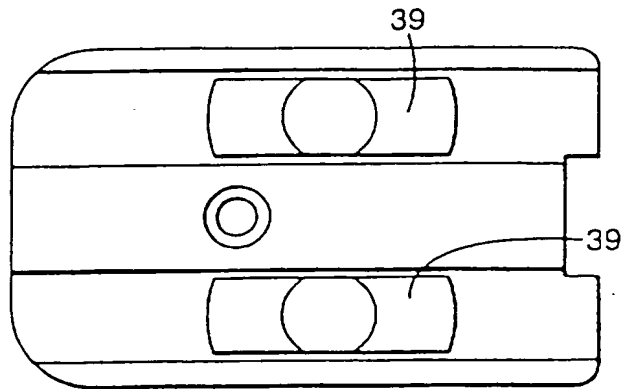


Fig. 6A

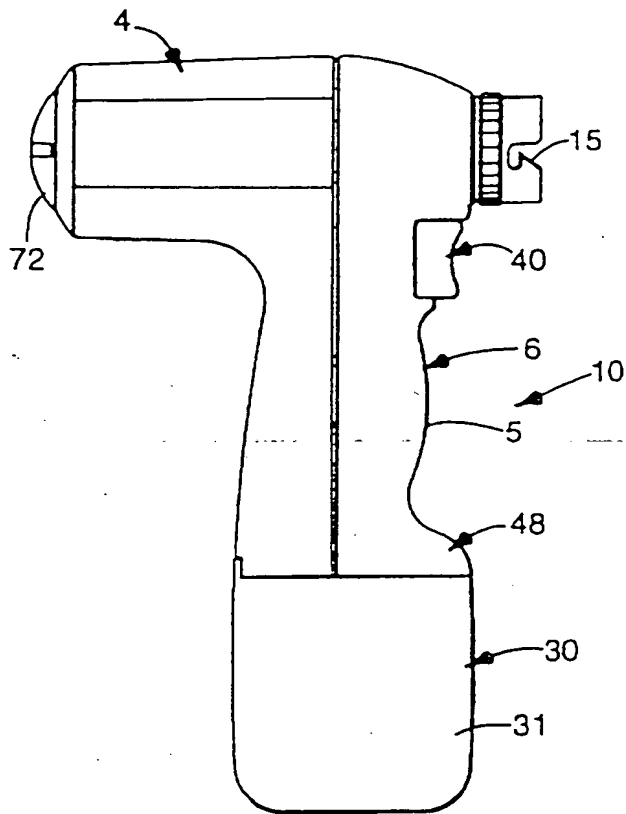


Fig. 7

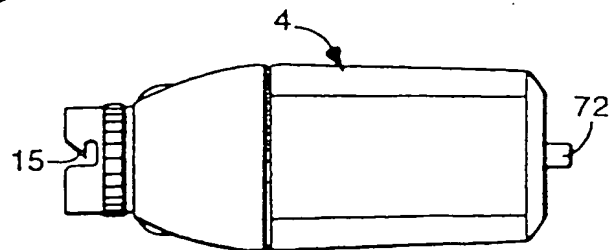


Fig. 8

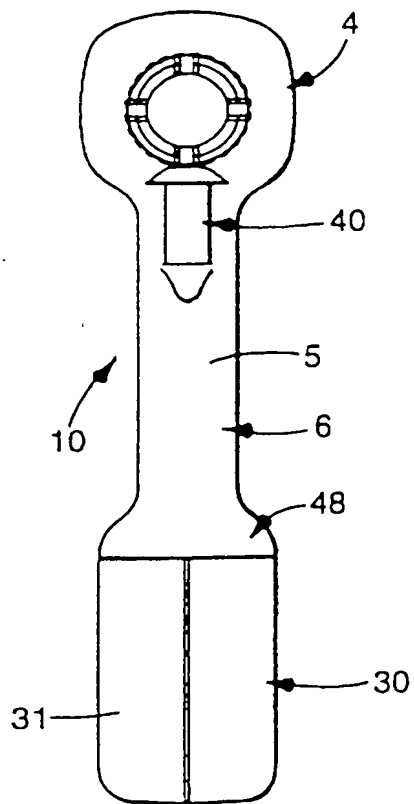


Fig. 9

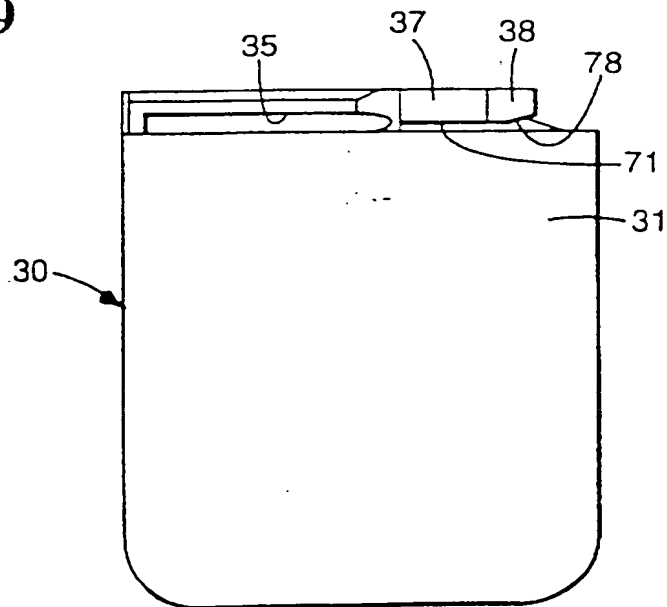


Fig. 10

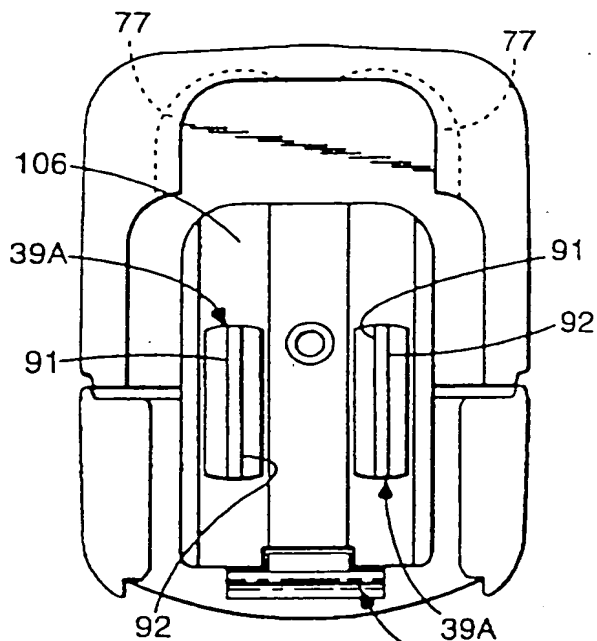


Fig. 11

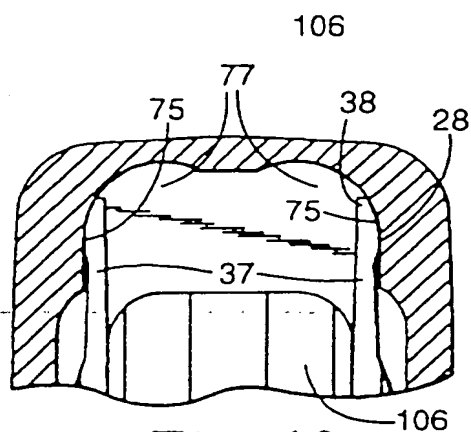


Fig. 12

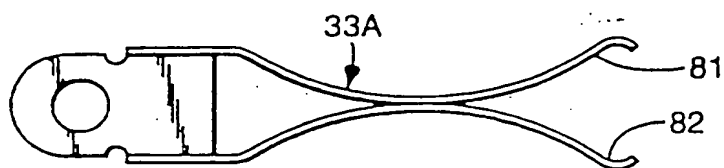


Fig. 13

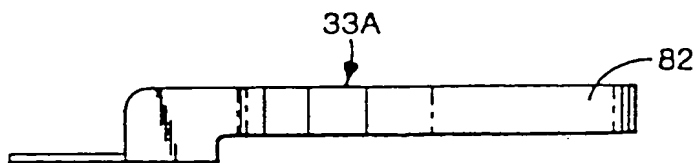


Fig. 14

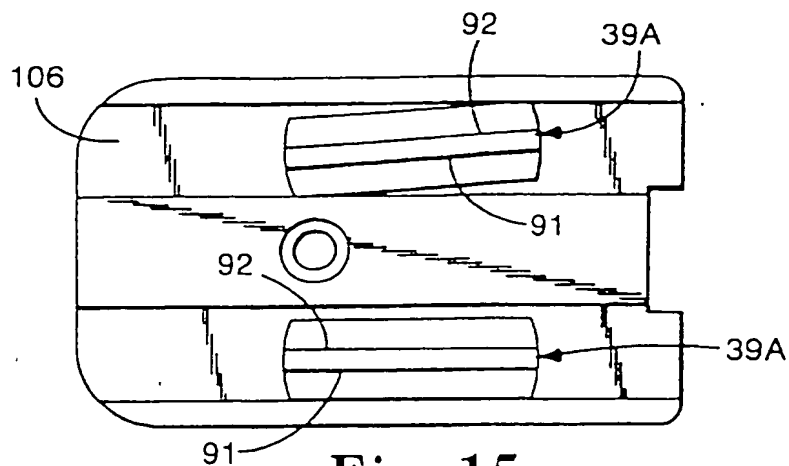


Fig. 15

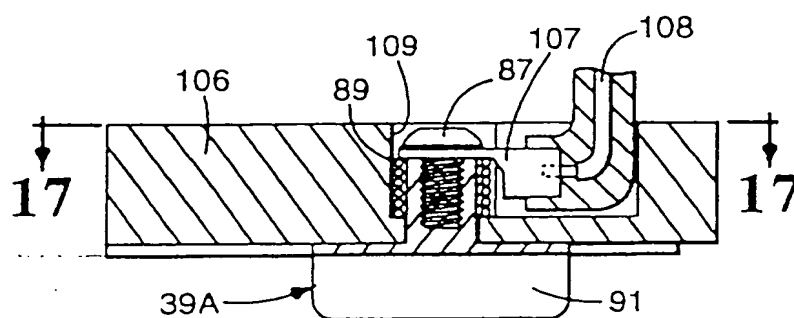


Fig. 16

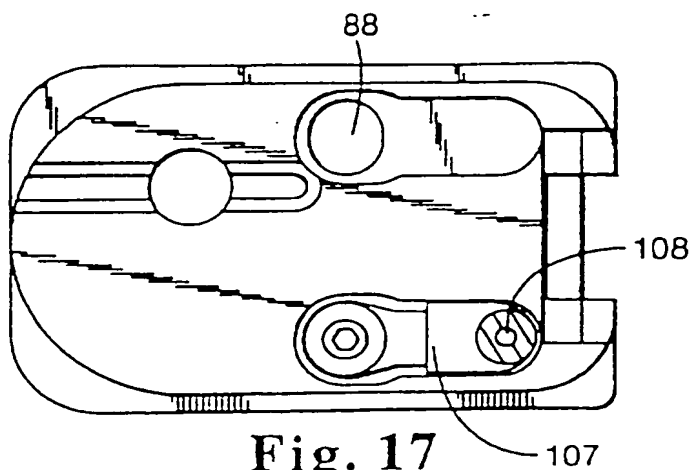


Fig. 17

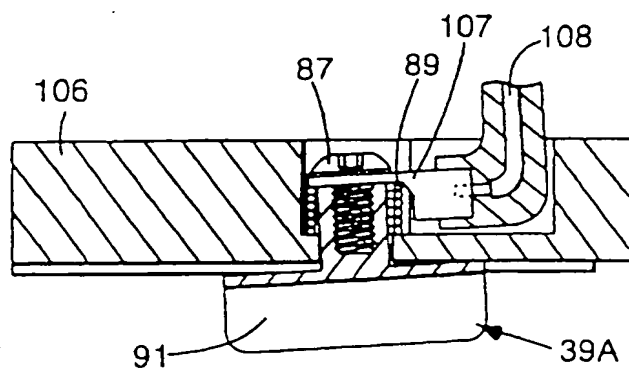


Fig. 18

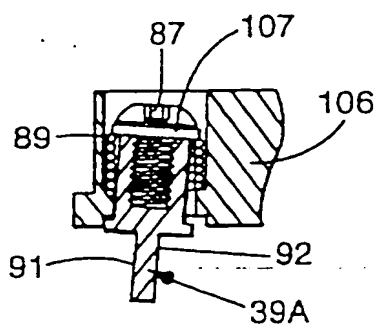


Fig. 19

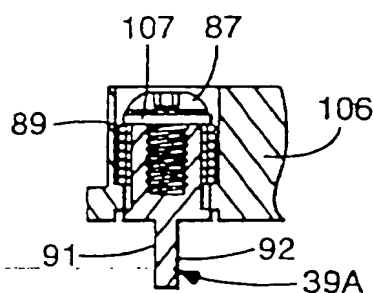


Fig. 20

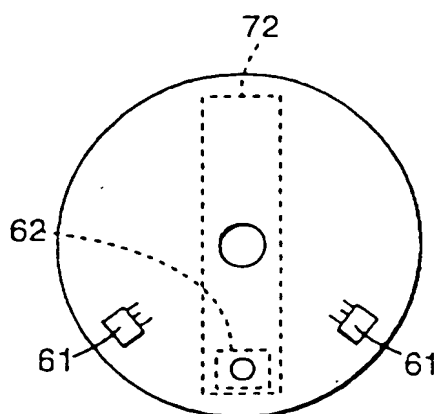


Fig. 21

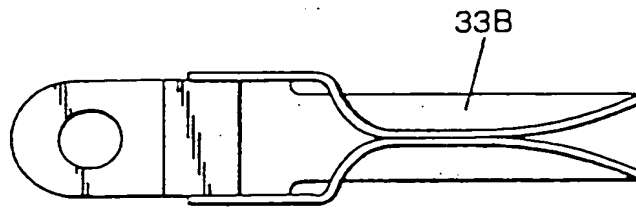


Fig. 22

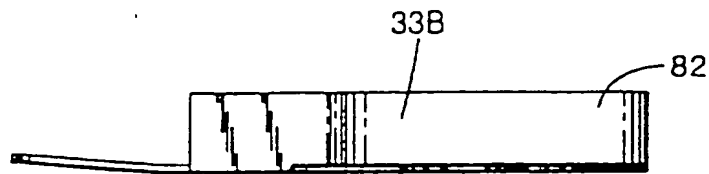


Fig. 23

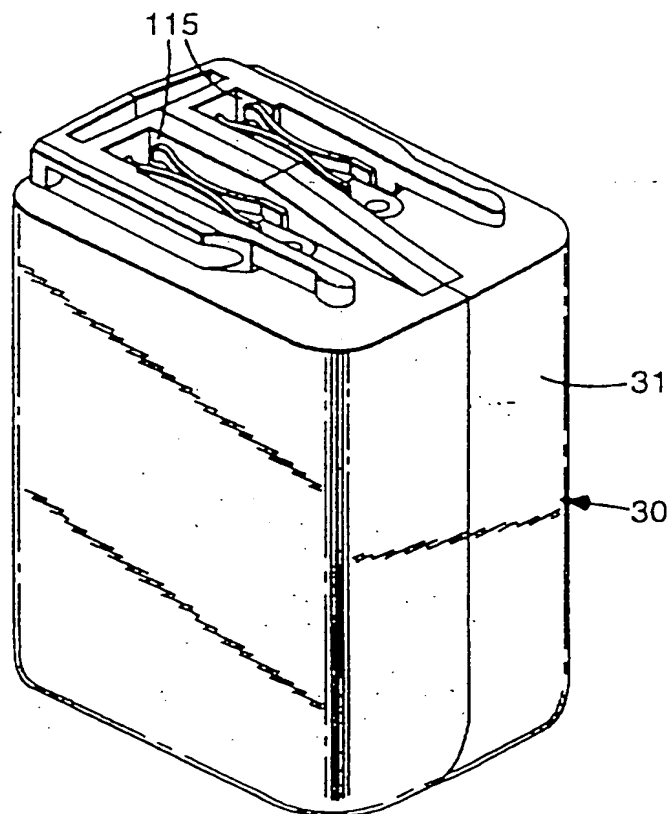


Fig. 24

RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO ORTHOPEDIC DEVICE

This application is a divisional of U.S. patent application Ser. No. 08/258,338, filed Jun. 10, 1994, now U.S. Pat. No. 5,553,675, issued Sep. 10, 1996.

TECHNICAL FIELD

The present invention is directed to cordless rechargeable battery powered drive assemblies for driving orthopedic surgical instruments.

BACKGROUND

Orthopedic drive assemblies are well known in the art. Such drive assemblies may be adapted for various orthopedic procedures such as drilling, screwing, reaming, wire driving, pinning and sawing (both reciprocating and sagittal). Typically a drive assembly is powered by either a rechargeable battery system (e.g. a cordless system) or by a pneumatic system which utilizes compressed fluid to power the device.

The art is replete with cordless rechargeable battery powered drive assemblies for driving orthopedic surgical instruments. Typically, such instruments comprise generally pistol-shaped devices having elongate handle and drive portions. Examples of such drive assemblies comprise: (1) the Orthopower 90 cordless instruments available from Stryker of Kalamazoo, Mich.; (2) the Cordless 200 Reamer, Cordless 800 Wire Driver, Cordless Sagittal Saw or Cordless 450 Orthopedic Drill available from Dyonics of Andover Md.; (3) the Maxion™ orthopedic drive device, previously sold by the Minnesota Mining and Manufacturing Co. (3M) of St. Paul, Minnesota; (4) the Hall Versipower orthopedic instruments available from Hall Surgical of Carpinteria California (associated with Zimmer); and (5) the product known as the 200 Reamer, previously sold by Black & Decker. Cordless battery powered drive assemblies for driving orthopedic surgical instruments are described in U.S. Pat. Nos. 3,734,207; 4,050,528; 4,091,880; 4,441,563; 4,641,076; 4,728,876 and 5,080,983.

Because the batteries in an orthopedic drive device are preferably rechargeable, releasable attachment means are provided in some prior art devices for releasably attaching a battery pack to the rest of the device. Typically, a battery pack is attached to and removed from the handle portion of the device in a direction that is substantially parallel to the axis of elongation of the handle portion. Individual batteries are placed in a housing creating the battery pack which is then attached to the device by being slid in a direction generally parallel to the elongate axis of the handle portion of the device. The battery pack typically includes electrical circuit connection means for connecting the battery pack to electronic circuitry in the device. A device typically secures the battery pack to the rest of the device.

While such releasable attachment means are generally acceptable, they leave room for improvement. One drawback of such a releasable attachment means is that gravity tends to continuously operate on the battery pack to urge it out of the device. Another drawback for some prior devices is that, because of the significant vibration forces encountered during use of the orthopedic drive assembly (particularly during sagittal sawing), the electrical circuit connection means tend to corrode. This type of corrosion is known as fretting corrosion. As used herein, the phrase "fretting corrosion" means surface degradation occurring at the interface of mating electrical contacts which results in the reduction or even loss of electrical continuity.

Fretting corrosion is found in components forming contacts which are allowed to move independently with respect to each other during current flow. This independent movement is believed to cause mechanical abrasion which will wear the surfaces. Gaping between the electrical contacts during electrical flow may result in electrical arcing with attendant generated heat potentially sufficient to melt the surface of the contacts. Pitting, welding and burning may also result. Also, a physical change in the material forming the contacts may occur. Plating for enhanced electrical contact may be lost and carbon deposits may accumulate resulting in reduced electrical continuity.

Because orthopedic drive assemblies are used in surgical procedures which require delicate yet physically demanding tasks, the balance and maneuverability of an orthopedic drive device is also important to surgeons. Hand fatigue is a problem associated with many existing drive assemblies as well as a general difficulty in maneuvering the device during some surgical procedures. Weight distribution and size considerations are believed to contribute to these problems, as the typical cordless rechargeable battery powered drive assembly may be cumbersome to hold and use, particularly during a delicate orthopedic procedure where only the highest quality is tolerated. Size and weight considerations involved in the placement of elements such as the batteries, transmission, electronic control circuitry and motor typically render an existing device difficult to maneuver.

Other prior art drive assemblies are excessively large. Oversized drive assemblies may be difficult to maneuver, particularly during a surgical procedure at a cramped or remote location.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention there is provided a drive assembly for driving orthopedic surgical instruments which (1) affords excellent balance and maneuverability for a user which offers enhanced handling characteristics and convenience during use, (2) affords attachment and removal of a battery pack in a direction other than the direction of elongation of the handle portion of the device, (3) includes a connection between the battery pack and the electronic circuitry of the device which resists fretting corrosion, (4) includes an ergonomically designed handgrip shape that fits a surgeon's hand comfortably, and (5) is sized for convenient maneuvering during an orthopedic surgical procedure.

According to the present invention, there is provided a drive assembly for driving various orthopedic surgical instruments, such as, but not limited to, drills, screws, reamers, wires, pins and saws (both reciprocating and sagittal). The drive assembly comprises a housing having elongate drive and handle portions with the handle portion projecting from the drive portion. A drive is present comprising a motor preferably mounted within the drive portion. The motor has a motor shaft, and the drive includes a transmission for transmitting power of the motor shaft to the surgical instrument. The transmission includes a drive member. Preferably the drive portion has surfaces defining a wire receiving chamber adapted to receive an orthopedic wire adapted to be driven during an orthopedic surgical procedure.

The drive assembly also includes a trigger assembly movable relative to the handle portion; and electrical circuit means operatively associated with the trigger assembly for controlling the motor.

The handle portion comprises a releasably attachable battery having at least one cell (preferably eight), a battery

housing, and a pair of battery contacts. The handle portion also has a battery receiving portion having battery terminals adapted to engage the battery contacts; and releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion. Preferably, the direction is a direction substantially parallel to the axis of the drive portion.

In the preferred embodiment, the releasable attachment means comprises a) the handle portion having a pair of tracks defining flanges that are elongate in a direction substantially parallel to the longitudinal axis of the drive portion, b) the battery having a pair of grooves adapted to receive the flanges of the tracks, and a pair of flexible, resilient cantilever members, and c) the battery receiving portion having surfaces defining a cantilever member cavity for receiving the pair of flexible, resilient cantilever members in an interference fit so that the battery is frictionally held in place relative to the battery receiving portion. A latch for releasably securing the battery to the battery receiving portion is also preferably present.

The drive assembly also includes a novel floating battery terminal assembly comprising biasing means for biasing the battery terminals toward a rest position, and mounting means for mounting the battery terminals for deflection from the rest position. In one embodiment, each of the battery terminals comprises a substantially flat plate member having opposite side surfaces, and each of the battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

Also preferably, the handle portion comprises a handgrip portion having outer surfaces that are sized and shaped to be grasped by a user without touching the battery, and inner surfaces defining a handgrip cavity. The handgrip cavity is free of the transmission, the motor and any cells of the battery when the battery is received in the battery receiving portion. Preferably, the cells of the battery are spaced on an opposite end of the handgrip portion than the motor and transmission.

Alternatively, the present invention may be described as a rechargeable battery adapted to be repeatedly and releasably attached to an orthopedic drive assembly. In this aspect of the invention, the orthopedic drive assembly has elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and surfaces defining a cantilever member receiving cavity.

The battery comprises an autoclavable battery housing having opposite top and bottom portions, at least one cell within the battery housing and a pair of battery contacts mounted adjacent the top portion of the housing and adapted to engage the battery terminals of the orthopedic drive assembly. Releasable attachment means are present for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion. The releasable attachment means and battery terminals comprise the preferred versions as discussed above.

In this aspect of the invention, the battery contacts each include a first end fixedly attached to the top portion of the battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing. The battery housing comprises opposite, substantially flat front and rear walls constructed from a material suitable for protecting the cell(s) during an autoclave procedure. The battery comprises eight substantially cylindrical cells having

longitudinal axes. The eight cylindrical cells are arranged in: a) a front row of three cells substantially adjacent a front wall of the battery housing, b) a rear row substantially adjacent a rear wall of the battery housing, and c) a middle row of two cells between the front and rear rows.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further described with reference to the accompanying drawing wherein like reference numerals refer to like parts in the several views, and wherein:

FIG. 1 is a perspective view of a drive assembly for driving orthopedic surgical instruments according to the present invention;

FIG. 2 is an enlarged sectional view of the drive assembly of FIG. 1, illustrating a battery pack of the device removed from the device in solid lines, and illustrating the position of the battery pack when attached to the drive assembly in phantom lines;

FIG. 3 is an enlarged perspective view of the battery pack for use in the drive assembly of FIG. 1;

FIG. 4 is an enlarged rear view of the drive assembly of FIG. 1;

FIG. 5 is a top view of the battery pack of FIG. 3;

FIG. 6 is a sectional view of the battery pack of FIG. 3;

FIG. 6A is a bottom view of portions of the drive assembly of FIG. 2 with the battery pack removed which illustrates battery terminals that are adapted to be connected to the battery contacts of the battery pack of FIG. 3;

FIG. 7 is an enlarged side view of the drive assembly of FIG. 1;

FIG. 8 is a top view of the orthopedic drive assembly of FIG. 7;

FIG. 9 is a front view of the drive assembly of FIG. 7;

FIG. 10 is a side view of the battery pack of FIG. 3;

FIG. 11 is an enlarged bottom view of a handle portion of a drive assembly with the battery pack removed to illustrate details of a second embodiment of battery terminals according to the present invention and with portions of a battery pack receiving cavity illustrated with dashed lines;

FIG. 12 is a partial sectional view of a battery receiving portion of the drive assembly and cantilever arms of the battery pack showing the position of the cantilever arms when the battery pack is attached to the rest of the orthopedic drive assembly;

FIG. 13 is a top view of one of a pair of preferred battery contacts for a battery pack according to the present invention, which battery pack is adapted to be connected to a drive assembly having the battery terminals of FIG. 11;

FIG. 14 is a side view of the battery contact of FIG. 13;

FIG. 15 is an enlarged bottom view of portions of the handle portion of the drive assembly of FIG. 11 which illustrates details of a pair of floating battery terminal assemblies including a battery terminal of one of the assemblies shown offset relative to the axis of the drive portion of the housing of the device;

FIG. 16 is a sectional view of a floating battery terminal assembly of FIG. 15 which illustrates details of a battery terminal in a rest position;

FIG. 17 is a sectional view of portions of the drive assembly of FIG. 16 taken approximately along lines 17-17 of FIG. 16 except that one battery terminal and connector are removed to illustrate details of a hole for receiving the battery terminal;

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FIG. 18 is a sectional view similar to FIG. 16 except that the floating battery terminal assembly is slightly offset from its rest position, as may occur during vibration of the orthopedic drive device;

FIG. 19 is a sectional view of the floating battery terminal of FIG. 17 with the battery terminal offset laterally with respect to its longitudinal axis in a rest position and with other portions omitted to illustrate details;

FIG. 20 is a sectional view of the floating battery terminal assembly of FIG. 17 with the battery terminal illustrated in a rest position and with other portions omitted to illustrate details;

FIG. 21 is a schematic illustration of a switch mechanism for use in the drive assembly according to the present invention;

FIG. 22 is a top view of another embodiment of battery contact for use with a drive assembly having the battery terminals of FIG. 11;

FIG. 23 is a side view of the battery contact of FIG. 22; and

FIG. 24 is a perspective view of a battery with the battery contacts of FIGS. 13 and 14.

DETAILED DESCRIPTION

Referring now to FIGS. 1 through 10 of the drawing there is shown an embodiment of a cordless rechargeable battery powered drive assembly for driving orthopedic surgical instruments according to the present invention, generally designated by reference character 10. The drive assembly 10 includes a housing comprising elongate drive 4 and handle 6 portions defining drive D and handle H portion longitudinal axes. The drive portion 4 and a significant portion of the handle portion 6 are constructed by assembling two large housing pieces (see FIG. 7) to afford convenient disassembly of the device for repair.

Referring now to FIG. 2, the drive assembly 10 includes a motor assembly having a D.C. electric powered motor 12 including a rotor 14 and a motor shaft 16. A drive is also present comprising a transmission for transmitting the power of the motor shaft 16 to the surgical instrument. The illustrated transmission includes a drive member or spindle 18, a ring gear 19, and a gear pin and planetary gear assembly 21.

Preferably, the motor 12 is mounted within the drive portion 4. As used in this application, when it is said that the motor is within the drive portion 4, it is meant that the rotor 14 and motor shaft 16 are substantially completely located within the structure of the housing defining the drive portion 4, as opposed, for example, to one of the rotor or motor shaft being located in the handle portion 6 or a substantial portion of the motor being located in the handle portion 6, of course some wires and electronic circuitry associated with the motor may be present outside the drive portion 4, and yet the motor will nevertheless be within the drive portion 4 as understood in the present invention. Also preferably, the transmission (e.g. 18, 19 and 21) is mounted within the drive portion 4.

A connector is provided for attaching a chuck or other such holder or instrument that may be driven by the drive assembly 10. The connector comprises a nose insert 26 having a socket into which a cylindrical portion of the surgical instrument can project with a splined central rotatable driven collar engaged with mating splines 17 on the inner surface of the drive member 18, and with pins (not shown) projecting radially of the cylindrical portion engaged

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in longitudinally extending slots 15 opening through the end of the housing. A helix pin/collar assembly 25 is rotatable about the axis D of the drive portion and is biased by torsion spring 27 so that circumferentially projecting hooks near slots 15 on the collar 25 can engage the pins on the surgical instrument to maintain the pins within the slots 15 and thereby the surgical instrument in driven engagement with the drive assembly 10.

The surgical instrument may comprise any instrument suitable for use in an orthopedic surgical procedure, including but not limited to, drills, screws, reamers, pins and saws (both reciprocating and sagittal) or a suitably designed chuck or adapter for use with any of the previously mentioned instruments.

As a particular example, the surgical instrument may comprise the chuck described in U.S. Pat. No. 4,728,876, the entire contents of which are herein expressly incorporated by reference. Alternatively, for example, an appropriate wire driving attachment adapter may be attached to the drive assembly 10 so that it may be used as an orthopedic wire driver, optionally, but not preferably, engagement between the orthopedic wire and the spindle 18 may afford operation of the device 10 as a wire driver.

A stationary member 22 extends from a proximal end 1 of the housing toward its distal end 3. Preferably, the stationary member 22 includes a through chamber so that a surgical wire may be passed through the stationary member 22 from the proximal end 1 of the device 10 toward the distal end 3. The through chamber in the stationary member 22 forms a portion of a wire receiving chamber in the drive portion 4 between the proximal end 1 and the distal end 3. Threading a surgical wire through the wire receiving chamber affords use of the device 10 as a wire driver.

O-rings 64 and 65 restrict internal contamination of the drive assembly 10 from ambient contaminants. O-ring 66 is compressed against member 22 to restrict the member 22 from rotating relative to the handle 6 and drive 4 portions of the housing.

The drive assembly 10 also includes a rechargeable battery or battery pack 30 that is adapted to provide a rechargeable source of power for the motor 12. Unique mounting means (described in greater detail below) attach the battery 30 to the rest of the assembly 10.

A trigger assembly 40 is movable relative to the handle portion 6. The trigger assembly includes a button member 45 adapted to be engaged by a user's digits, a trigger shaft 46, an O-ring seal 41 for fixedly connecting the button member 45 to the trigger shaft 46, a coil spring 42 and magnet 44 that is rigidly attached to the trigger shaft 46. The trigger assembly 40 is movable between a released or extended position (FIG. 2) and a depressed or inner position relative to the handle portion 6.

The drive assembly 10 also includes electrical circuit means operatively associated with the trigger assembly 40 for controlling the motor 12. The illustrated electrical circuit means comprises an on/off hall sensor 52 and a speed control hall sensor 54.

The on/off hall sensor 52 is a digital hall sensor having an output signal with two levels corresponding to an on state and an off state. The on/off hall sensor 52 senses the presence of a magnetic field from the magnet 44 on the trigger assembly 40. When the trigger assembly 40 is released, the magnet 44 is positioned directly over the on/off hall sensor 52 (FIG. 2). The magnetic field of the magnet 44 causes the on/off hall sensor 52 to produce an output signal corresponding to an off state. As the trigger assembly 40 is

depressed, the magnet 44 moves away from the on/off hall sensor 52. The on/off hall sensor 52, no longer sensing the presence of a magnetic field, produces an output signal corresponding to an on state.

The output signal from the on/off hall sensor 52 is conditioned by electrical circuitry which provides a standby signal when the on/off hall sensor 52 produces an off signal. The standby signal disables motor drive circuitry and the speed control hall sensor 54. The standby signal therefore ensures that the motor 12 is off whenever the trigger assembly 40 is in a released position (FIG. 2). An added benefit of disabling the motor drive circuitry and the speed control hall sensor 54 is that the electrical power required by the device 10 is significantly reduced during periods when the trigger assembly 40 is not depressed. This current reduction during a standby mode improves energy efficiency of the device 10. In this manner, the device 10 may optionally include a battery saver feature.

The speed control hall sensor 54 is a linear hall sensor which provides a speed control signal having a range of levels based upon the strength of the magnetic field that the variable speed hall sensor 54 detects. As the strength of the magnetic field increases, the speed control hall sensor 54 produces a speed control signal with a higher level. As the trigger assembly 40 is depressed, the magnet 44 moves towards the speed control hall sensor 54 and increases the magnetic field across it. The speed control signal from the speed control hall sensor 54 is conditioned and drives the motor control circuit to provide motor speeds proportional to the speed control signal. Therefore, as the trigger assembly 40 is further depressed, the motor control circuitry increases the motor speed of the drive assembly 10. In this manner, the drive assembly 10 may optionally comprise a variable speed device.

The circuit has a 25 amp current limit to protect the batteries, motor and electronics. The electrical circuit means may optionally include directional drive circuitry which is discussed in greater detail below.

As best seen in FIGS. 2 and 6A, the device 10 also comprises battery terminals 39. Each of the battery terminals 39 have three generally flat surfaces including two end surfaces situated at an angle relative to a middle surface. The function of the battery terminals 39 will be described in greater detail below.

The battery terminals 39 may be constructed from any suitable material appropriate for use to construct orthopedic surgical tools. For example, the battery terminals may be constructed from copper, brass, bronze, beryllium copper, stainless steel, steel and aluminum. One or more platings may be present to enhance the electrical conducting and corrosion resisting properties of the battery terminals 39. Examples of such platings include, but are not limited to copper, nickel, gold, silver, tin, electroless nickel, rhodium, sulfamate, nickel, cadmium and zinc.

The handle portion 6 of the device 10 projects (downwardly in FIG. 2) from the drive portion 4 of the device 10. The handle portion 6 of the housing comprises the battery 30 and a handgrip portion 5. The handgrip portion 5 has manually engageable or graspable surfaces and top T and bottom B ends (see FIG. 2). Preferably, the handgrip portion 5 is sized and shaped so that, during use of the device 10, the user does not need to grasp any portion of the battery 30. For example, the handgrip portion 5 may have a height from its bottommost point to the bottom of the drive portion 4 of less than approximately 6 inches (preferably about 4.5 inches), a width of its neck portion of less than about 2.8

inches (preferably about 1.1 inches), and a length of its neck portion of less than about 2.5 inches (preferably about 1.3 inches).

The handgrip portion 5 includes specially shaped surfaces that result in a handle that is comfortably held in the hand of a surgeon. A middle part of the handgrip 5 includes an curved front surfaces to form a conveniently held handle. A lip portion 51 is situated adjacent the button member 45 to restrict the chance that a surgeon's glove may be caught between the handle portion 6 and the button 45 when the button 45 is depressed.

As shown in the figures, the width and length of the handgrip portion 5 vary along its height to afford convenient grasping of the device 10. The bottom of the handgrip portion 5 includes a battery receiving portion 48 having the battery terminals 39 adapted to engage battery contacts 33 (described in greater detail below) when the battery 30 is attached to the battery receiving portion 48.

A battery housing 31 (FIGS. 2 and 3) preferably comprises opposite, substantially flat front 201 and rear 203 walls constructed from an autoclavable material. An autoclavable material is a material suitable for protecting battery cell(s) during repeated autoclave procedures. Examples of suitable materials are described below.

The battery 30 comprises at least one rechargeable cell 32 and preferably eight substantially cylindrical cells 32 as shown in FIG. 2. Because the cells 32 are located in a position below or remote from where a user is expected to grasp the drive assembly 10, the handgrip portion is free to be used for mounting other electrical and/or mechanical components such as an electronic printed circuit board forming a portion of the electrical circuit means discussed above.

The battery 30 preferably comprises eight substantially cylindrical cells 32 having longitudinal axes. The axes of the cells are preferably substantially parallel to the front and rear walls 201 and 203. The eight cylindrical cells 32 are arranged in a front row F of three cells substantially adjacent the front wall 201, a rear row R of three cells substantially adjacent the rear wall 203, and a middle row M of two cells between the front and rear rows 201 and 203. All of the rows F, M and R are enclosed within the battery housing 31 so that the cells are protected during an autoclave or other sterilization procedure.

The weight distribution of the device 10 is substantially balanced about the handgrip portion 5 as the relatively heavier elements such as the battery cells and the motor/transmission assemblies of the device 10 are spaced on opposite ends (top T and bottom B) of the handgrip 5. A handgrip cavity 53 is formed within the inner portions the handgrip 5. As opposed to prior art devices which include a battery or motor within the portion of its housing that is designed to be manually grasped, the cavity 53 is free of batteries or motors or transmission or gear assemblies. Since battery cells 30 (described in greater detail below) are situated below the battery receiving portion of the handle portion 6, some of the electronic control circuitry mentioned above may be placed in the handgrip cavity 53 of the handle portion 6. This is believed to further contribute to the beneficial balance and handling characteristics of the device 10.

The cells 32 are preferably stacked in the manner shown in FIG. 2, with a distal row of three cells placed at the front of the battery 30, a proximal row three cells at the rear of the battery 30, and a middle row of two cells placed between the front and rear cells. The axes of the cells are perpendicular

to the axis D of the drive portion of the housing. The cells 32 may comprise, for example, nickel-cadmium secondary (rechargeable) sub "C" size cells with a 22 mm diameter and a 34 mm length in a nickel-plated steel case. Such cells are expected to provide a capacity of about 1.4 amp hours at 9.6 volts, D.C. Suitable cells may be obtained from Saft of Valdosta, Ga.; Panasonic of Japan; Sanyo Electric Co. Ltd. of Sumoto-City, Hyogo Japan or Gates available from DC Battery Products of St. Paul, Minn.

The cells 32 are enclosed in an autoclave proof (saturated steam @ 280 degrees Fahrenheit, @ 30 pounds per square inch, and vacuum @ 26 inches of mercury) housing or casing 31. The casing 31 preferably is designed to withstand other sterilization techniques and remain suitable to protect the battery cells 32. The casing 31 includes a poppet or umbrella valve 8 (e.g. the #VL2491-102 Vernay valve generally available from Vernay of Calif.) to relieve any pressure, such as pressure generated by the cells 32. Optionally, the battery housing 31 may include a power terminal (not shown) for a power cord so that the drive assembly 10 may be powered without discharging the cells 32.

The particular material used to construct the casing 31 may comprise any suitable material for use in an orthopedic device. Specific examples include, but are not limited to, poly-ether-imide (PEI) including Ultem (e.g. GE grades 1000 Black #7101, 1000 Black #1000, 2100 muddled natural #1000 10% glass fill, 2200 muddled natural 20% glass fill, 3452 muddled natural #1000 45% short glass and mineral, or 6200 muddled natural #1000 20% glass fill high temperature); poly-phenyl-sul-fone (PPSU) (e.g. Amoco Radel R, grades RS100 Black #935 or #937, or R 5000, natural); polysulfone (PSU) (e.g. Amoco Udel P, grade P 1700, natural #11); polyaryletherketone (PAEK) (e.g. BASF Utrapek, grade KR4176, natural); liquid crystal polymer (LCP) (e.g. Vectra grades A950 natural, A530 muddled-natural moderately mineral filled, or A130 muddled natural 30% glass fill); and polyketone (PEK) (e.g. Amoco Kadel E grade 1000 natural).

The motor 12 of the drive assembly 10 is designed to: (1) operate between about 9.6 volts and a reduced voltage which is the output range the battery will produce under load, and (2) have very low internal resistance to restrict internal losses when handling the high current flow by which it is powered. Since the motor 12 and transmission are relatively heavy elements of the device 10 (e.g. the motor may weight about 0.82 pounds), the motor 12 and transmission are preferably located within the drive portion 4 of the housing. Locating the motor 12 and transmission in a position spaced from the handgrip cavity 53 frees the handgrip cavity 53 for use to store the electronic circuitry of the device 10. The location of the motor 12 and transmission also contribute to the beneficial balance and weight distribution of the device 10 and improves its handling characteristics. These improvements are believed to reduce hand fatigue for some users.

The battery 30 shown in FIGS. 1-7, 9 and 10 comprises the battery housing or casing 31, and a pair of battery contacts 33, one of which is an electrically positive terminal, the other of which is an electrically negative terminal. The battery contacts 33 comprise thin, arcuate contact members. The arcuate contact members 33 are connected at one end to the housing 31 and are in electrical communication with the cells 32 (which are connected in series by electrically conductive strips). The other end of the contact members 33 is free to float along the top of the casing 31. Preferably, the contacts 33 are constructed from a flexible, resilient elec-

trically conductive material, such as a material selected from the group comprising copper, brass, bronze, beryllium copper, nickel, stainless steel, aluminum or steel. Optionally, one or more materials may be plated to the contacts to enhance their performance and corrosion resistance. Plating materials include, but are not limited to gold, copper, nickel, silver, tin, electroless nickel rhodium, sulfamate nickel, cadmium and/or zinc. The shape of the arcuate contact/members 33 afford their resilient deflection in a direction substantially parallel to the axis H of the handle portion 6 of the housing upon abutment with the battery terminals 39.

Referring now to FIGS. 11, 13-14, 15-16, 18-20 and 24 of the drawings, there is shown a second embodiment of cooperable battery terminals and battery contacts according to the present invention with the battery contacts designated with reference character 33A and the battery terminals designated by reference character 39A.

As best seen in FIG. 16, handgrip 5 has a portion constructed from an electrically insulating material 106. The battery terminals 39A are each attached to the insulating material 106 by screw 87. A crimp-on connector 107 is situated between the screw 87 and the battery terminal 39A. The crimp-on connector 107 places the battery terminal 39A in electrical communication with the rest of the electrical circuit means by virtue of insulated wire 108.

The battery terminals 39A are mounted on the manually graspable portion 5 of the housing to float relative to the rest of the housing (including the insulating portion 106). This feature is particularly useful when the device 10 generates vibration as the floating battery terminals 39A tend to retain electrical communication between the battery 30 and the rest of the electronics of the device 10.

The battery terminal 39A is placed in an oblong hole 88 in the handgrip portion 5 of the housing. The oblong hole 88 preferably affords side to side float (movement in a direction that is substantially perpendicular to both axes H and D) of the battery terminal 39A (see FIG. 19), but restricts float of the battery terminal 39A in a direction substantially parallel to the axis D so that the battery terminal 39A is not unduly deflected upon insertion and removal of the battery 30 from the device 10.

A coil spring 89 is provided to afford float of the battery terminal 39A and to bias the battery terminal 39A toward a rest position (see FIGS. 16 and 20). The coil spring 89 has a pair of ends, one of which abuts the crimp-on connector 107, and the other of which abuts the insulating portion 106 of the housing. A rest position of battery terminal 39A is shown in FIG. 16. When the battery terminal 39A is deflected from its rest position (such as when the device 10 vibrates during an orthopedic surgical procedure), the spring 89 deflects in compression from its rest position and biases the battery terminal 39 toward its rest position. Alternatively, the spring 89 may be designed to deflect in tension from its rest position to bias the battery terminal 39 toward its rest position.

The screw 87, crimp-on connector 107, coil spring 89 and portions of the battery terminals 39A are situated within cavity 109 in the handgrip 5. The cavity 109 has a diameter at least slightly larger than the diameter of the screw 87 to afford float of the battery terminals 39A. Unlike the battery terminals 39, the battery terminals 39A comprise a substantially flat, rectangular contact member having a pair of opposite sides 91 and 92 for contacting the battery contacts 33A.

Battery contact 33A for use with the battery terminals 39A is shown in FIGS. 13, 14 and 24. Each of the battery contacts

33A include a pair of flexible, resilient deflecting members 81 and 82. The flexible, resilient deflecting members 81 and 82 each have a first end rigidly affixed to the battery housing 31, and a second end, opposite the first end. The second end of the members 81 and 82 is free to slide along the top of the casing 31 when the members 81 and 82 are deflected. A support shoulder surface 115 of the top portion of the battery housing 31 receives the second end of the members 81 and 82 and affords sliding movement of the second ends of the members 81 and 82.

The battery terminal 39A is designed to be sandwiched between the flexible, resilient deflecting members 81 and 82 and to deflect the members 81 and 82 in a direction that is substantially perpendicular to both of the axes H and D during vibration of the battery terminals 39A. Preferably, side 91 of the battery contact 33A is in electrical communication with deflecting member 81, and side 92 of the battery contact is in electrical communication with deflecting member 82.

The battery contacts 33A are constructed from a flexible, resilient, electrically conductive material. Any of the materials and platings mentioned above for use in constructing the battery contacts 33 may be used to construct the battery contacts 33A. Particular examples include beryllium copper, Brush Wellman alloy 25, 0.0159 (26 Ga) thick, 1/4 H temper, or equivalent UNS No. C17200, (ASTM temper TD01) heat treated 2 hours @ 600 degrees Fahrenheit (ASTM TH01), R/C 38-43. As an example not intended to be limiting, the contacts 33A may have an overall height in FIG. 14 of about 0.17 inches, an overall length (FIG. 13) of about 1.44 inches and an overall width of approximately 0.32 inches.

FIGS. 22 and 23 illustrate another embodiment of battery contact 33B for use with a drive assembly having the battery terminals of FIG. 11. The battery contact 33B is similar to the battery contact 33A except in that the contact 33B has a slightly different shape when viewed in the top view.

The handle portion 6 of the housing has a releasable attachment means for releasably attaching the battery 30 to the battery receiving portion 48 in a direction other than the direction of elongation of the handle portion 6. In the illustrated embodiment, that means comprises surfaces on the battery receiving portion 48 defining track portions 49 with flanges that are elongate in a direction substantially parallel to the longitudinal axis D of the drive portion. The battery 30 has a pair of opposite mounting grooves 35 adapted to cooperably receive the flanges of the track portions 49 (see FIGS. 4 and 6).

The battery pack 30 also has a pair of flexible, resilient cantilever members 37 having opposite ends. Each of the cantilever members 37 has a first end attached to the battery housing 31 and an enlarged distal end 38. The cantilever members 37 project from the structure defining the grooves 35 in a direction other than direction of elongation of the handle portion 6 (preferably in a direction substantially parallel with the top of the battery and the drive portion axis D). Referring now to FIG. 11, the battery receiving portion 48 of the housing includes a cantilever member receiving cavity 77 formed in part by a relatively thin shelf. The cantilever member receiving cavity 77 includes radiused side walls 75 (see FIG. 12).

The flexible, resilient cantilever members 37 are shown mounted in the cantilever member receiving cavity 77 in FIG. 12. When the battery 30 is mounted on the battery receiving portion 48, the flexible, resilient cantilever members 37 interfere with the surfaces defining the cantilever member receiving cavity 77 to resist movement of the

battery 30 relative to the rest of the device 10, particularly movement in the D axis direction. The flanges of the track 49 cooperably engage the grooves 35 and prevent the battery 30 from separating from the rest of the device 10.

The distal ends 38 of the flexible, resilient cantilever members 37 have a bevel 78 to allow them to ramp onto the shelf forming the cavity 77. The engagement between the bevel 78 and the shelf forming the cavity 77 forces the flexible, resilient cantilever members 37 upward in the H axis direction (in FIG. 2) when the battery 30 is mounted in the battery receiving portion 48. Consequently, the battery 30 is forced into abutment with the manually grasping portion 5. When the battery 30 is fully mounted in the battery receiving portion 48: (1) portion 71 (see FIG. 3) of the battery housing 31 is preferably in contact with the bottom side of the shelf forming the cavity 77, and (2) the flexible, resilient cantilever members 37 are in engagement with the side surfaces forming the cavity 77 which results in a pinching interference fit that tends to resist transmission of vibration to the contacts 33 or 33A. The pinching interference holds the flanges of the track portions 49 in engagement with the grooves 35 of the battery housing 31 to retain the battery 30 attached to the handgrip 5.

The enlarged distal ends 38 of the flexible, resilient cantilever members 37 have an outward biased radius 28. When the battery 30 is inserted into the receiving portion 48 of the handle portion 6, the outward biased radius 28 contacts the radiused side wall 75 (FIG. 12). The width between the outermost portions of the two distal end outward biased radiuses 28 is greater than the width of the radiused side walls 75. With this difference in widths, the flexible, resilient cantilever members 37 are forced inward when the battery 30 is received in the battery receiving portion 48 thereby generating a resistance to movement. For example, the interference is preferably less than about 0.1 inches and is more preferably less than about 0.02 inches. This slight interference causes the resilient members 37 to deflect and to provide excellent frictional contact with the cavity 77 in the battery receiving portion 48. In the manner described above, the cantilever members 37 stabilize the front end of the battery 30. This is especially effective in resisting movement when using the instrument is used for oscillating sawing where side to side forces (perpendicular to the axis H) are generated.

Preferably, the flexible, resilient cantilever members 37 comprise a single, unitary, integral monolithic piece with the battery housing 31. Thus, the material for the battery housing 31 should be sufficiently durable for forming a battery housing (e.g. it should be able to withstand autoclaving procedures), and yet resiliently flexible to accomplish the repeated interference fit of the flexible, resilient cantilever members 37 and cavity 77. Any suitable materials may be used including the materials discussed above as suitable for use to construct the casing 31. Alternatively, the flexible, resilient cantilever members 37 may be constructed from a material different than the material used to construct the casing 31.

When the drive assembly 10 is held in the position referenced in FIG. 2, the mounting grooves 35 and flanges of the track portions 49 are cooperable to resist the effect of gravity on the device 10 which, in prior art devices, tends to urge the battery away from contact with the rest of the device. A latch 56 is provided for releasably securing the battery 30 to the battery receiving portion 48, and for retaining the electrical contact between contacts 33 of the battery 30 and the battery terminals 39 (or the terminals 39A with the contacts 33A) of the battery receiving portion 48.

The latch 56 comprises a blocking member 57 mounted on the lower portion of the housing 6 for movement between a latched (FIG. 4) and a release position. A coil spring 58 biases the blocking member 57 toward the latched position. The latch 56 also includes the battery housing 31 having surfaces defining slot 34 for receiving a chamfered end 55 of the blocking member 57.

In the latched position, (1) the mounting grooves 35 of the battery 30 are received in the track portions 49 (see FIG. 4) in the battery receiving portion 48, and (2) the chamfered end 55 of the blocking member 57 is biased into engagement with the slot 34 of the battery 30 to lock the battery 30 to the battery receiving portion 48 of the housing. Indicia 59 may be present to provide user information such as how to unlatch the battery 30.

The latch 56 also includes means for automatically moving the blocking member 57 from the latched toward the release position as the battery 30 is mounted to the battery receiving portion 48. That means comprises the battery housing 31 having a ramp surface 36 adapted to engage the chamfered end 55 on the blocking member 57.

Referring to FIG. 2, as the battery 30 is slid into the track portions 49 of the battery receiving portion 48, the ramp surface 36 engages the chamfered end 55 on the blocking member 57 and cams the blocking member 57 toward the release position, thereby enabling the flanges of the track portions 49 to be slid into the corresponding, cooperable grooves 35 of the battery housing 31. Once the battery 30 is fully mounted on the battery receiving portion 48, the chamfered end 55 of the blocking member 57 is biased into engagement with the slot 34 of the battery housing 31 as described above. The side of the blocking member 57 opposite chamfered end 55 is not chamfered to resist inadvertent release of the battery 30.

As a portion of the electrical circuit means mentioned above, the drive assembly 10 also includes a convenient rotary switch means, operated by ribbed member 72 on the proximal end 1 of the drive housing 4 opposite drive member 18, for causing the motor 12 to rotate the drive member 18 either in forward or reverse (clockwise or counterclockwise) directions, or to prevent any rotation by the motor 12 even when the trigger 40 is moved to its inner position. Indicia 73 indicate when the device is in the forward, reverse or stop modes.

FIG. 21 is a schematic illustration of the switch means. The motor control switch with forward, off and reverse positions is preferably mounted behind the motor. The motor control switch includes a rotatable knob 72 with an attached magnet 62 and a detent mechanism 63 with three positions that correspond to the forward, off and reverse positions. When the knob is rotated fully clockwise, the magnet 62 by its magnetic field, activates one of two hall sensors 61 to run the motor counter-clockwise when facing the output shaft. When the knob is rotated fully counter-clockwise, it will reverse the motor. A center, neutral (off) position is also included.

The present invention has now been described with reference to several embodiments thereof. It will be apparent to those skilled in the art that many changes or additions can be made in the embodiments described without departing from the scope of the present invention. Thus, the scope of the present invention should not be limited to the structures described in this application, but only by structures described by the language of the claims and the equivalents of those structures.

What is claimed is:

1. A rechargeable battery adapted to be repeatedly and releasably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and a blocking member movable between latched and release positions;

said battery comprising:

an autoclavable battery housing having top and bottom portions, at least one cell within the battery housing and a pair of battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly,

releasable attachment means for releasably attaching the battery to the battery receiving portion in a direction other than the direction of elongation of the handle portion,

said releasable attachment means comprising:

- a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
- b) a slot for receiving the blocking member when the blocking member is in the latched position.

2. A rechargeable battery according to claim 1 wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and

each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

3. A rechargeable battery according to claim 1 wherein said battery contacts each include a first end fixedly attached to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

4. A rechargeable battery according to claim 1 wherein said battery housing comprises opposite, substantially flat front and rear walls constructed from a material suitable for protecting the cell(s) during an autoclave procedure,

said battery comprises eight substantially cylindrical cells having longitudinal axes, said eight cylindrical cells being arranged in:

- a) a front row of three cells substantially adjacent said front wall within the battery housing,
- b) a rear row of three cells substantially adjacent said rear wall within the battery housing, and
- c) a middle row of two cells between said front and rear rows wherein all eight cells are within the battery housing.

5. A rechargeable battery according to claim 1 wherein the slot is sized and shaped to engage the blocking member to lock the battery to the battery receiving portion when the blocking member is in the latched position.

6. A rechargeable battery according to claim 1 wherein the battery further includes means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

7. A rechargeable battery according to claim 6 wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

8. A rechargeable battery adapted to be repeatedly and releasably attached to an orthopedic drive assembly, the orthopedic drive assembly having elongate drive and handle portions, a battery receiving portion having a pair of tracks defining flanges, a pair of battery terminals, and a blocking member movable between latched and release positions;

said battery comprising a battery housing having top and bottom portions, at least one cell within the battery

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housing, and a pair of battery contacts adjacent the top portion of the housing and situated to engage the battery terminals of the orthopedic drive assembly when the battery is fully received by the orthopedic drive assembly.

releasable attachment means for releasably attaching the battery to the battery receiving portion, said releasable attachment means comprising:

- a) the battery having a pair of grooves adapted to receive the flanges of the tracks, and
- b) a slot for receiving the blocking member when the blocking member is in the latched position, wherein the slot is sized and shaped to engage the blocking member to lock the battery to the battery receiving portion when the blocking member is in the latched position.

9. A rechargeable battery according to claim 8 wherein the battery further includes means for automatically moving the blocking member from the latched toward the release position as the battery is mounted to the battery receiving portion.

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10. A rechargeable battery according to claim 9 wherein the means for automatically moving the blocking member comprises a ramped surface on the top portion of the battery housing.

11. A rechargeable battery according to claim 8 wherein each of the battery terminals comprise a substantially flat plate member having opposite side surfaces, and

each of said battery contacts comprise a pair of flexible, resilient arcuate members which are adapted to engage opposite side surfaces of a battery terminal.

12. A rechargeable battery according to claim 8 wherein said battery contacts each include a first end fixedly attached to said top portion of said battery housing and a second end adapted to abut a support shoulder of the top portion of the battery housing.

* * * * *

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	James F. Pitzen <i>et al.</i>	Examiner:	
Patent No.:	5,792,573	Group Art Unit:	1714
Assignee:	Linvatec Corporation	Application No.	09/954,526
Filed:	July 24, 1996	Docket No.:	54525.000055
Issued:	August 11, 1998	Parent Application No.	09/637,339
Title:	RECHARGEABLE BATTERY ADAPTED TO BE ATTACHED TO ORTHOPEDIC DEVICE		

DECLARATION OF PATRICK A. DOODY

I, Patrick A. Doody, hereby declare and state as follows:

- 1) I am a patent attorney registered to practice before the United States Patent and Trademark Office (PTO). My registration number is 35,022.
- 2) I am a partner with the law firm of Hunton & Williams, having an office at 1900 K Street, N.W., Washington, D.C. 20006.
- 3) I make this Declaration in support of the "Petition Under 37 C.F.R. §1.47(b) for Acceptance of the Reissue Application Without Participation of One or More Inventor" that is filed concurrently herewith.
- 4) I make the following statements based on facts that have either been personally conveyed to me or that I have obtained from various documents:

4a) Linvatec Corporation purchased a number of assets of 3M's Medical Surgical Division on June 29, 1999, one of which was Pitzen, *et al.*, United States Patent No. 5,792,573 ("the Pitzen patent"). The originally named inventors of the Pitzen patent, Mr. James F. Pitzen, Mr. Jeffrey D. Smith, and Mr. Charles E. Alexson assigned their entire right, title, and interest in and to the Pitzen patent, and any reissues thereof, to 3M by virtue of an Assignment recorded at Reel 7042, Frame 559-561, a copy of which is attached hereto as EXHIBIT 1. 3M subsequently assigned its right, title, and interest in and to the Pitzen patent, including any reissues thereof, to Linvatec Corporation by virtue

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of an assignment executed by Gary Griswold, Staff Vice President of 3M, on September 19, 2000, a copy of which is attached hereto as EXHIBIT 2.

4b) I am authorized to sign the Reissue Declarations filed concurrently herewith on behalf of the assignee, Linvatec Corporation.

4c) Each of the inventors of the Pitzen patent has refused to sign the Reissue Declarations. The facts underlying their respective refusals are set out herein:

4c1) It was my understanding that each of the inventors of the Pitzen patent was represented by an attorney at 3M because the inventors were employed by, and assigned their entire right, title, and interest in and to the Pitzen patent to, 3M at the time the Pitzen patent was filed. I therefore communicated with 3M's Intellectual Property Counsel instead of the inventors directly. During the course of my communications, it was brought to my attention that one of the inventors of the Pitzen patent, Mr. Charles E. Alexson, was no longer employed by 3M. I advised Mr. Robert Sprague, Assistant Chief Intellectual Property Counsel for 3M, that I would contact Mr. Alexson directly, and he consented. Mr. Sprague also informed me that the other two inventors, Mr. James E. Pitzen, and Mr. Jeffrey D. Smith, still were employed by 3M. I therefore contacted Mr. Alexson and spoke with him about signing the Reissue Declaration. Mr. Alexson informed me that he wanted to speak with 3M's attorneys prior to making his decision.


4c2) I contacted Mr. Alexson again on or about December 4, 2001. I asked Mr. Alexson whether he would be willing to sign the Reissue Declarations, and I explained to him briefly the invention recited in the reissue claims. Mr. Alexson informed me that he was going to do whatever the 3M attorneys decided to do, and if the 3M attorneys would refuse to grant access to the inventors, then he would not sign the Reissue Declarations. I informed him that I would be sending the Reissue Declaration and accompanying documents to his home address for him to sign, and suggested to him that, if he did not want to sign it, then he should refuse delivery or return the contents of the package with the Reissue Declarations unexecuted. I forwarded via registered mail a letter to Mr. Charles A. Alexson on December 14, 2001. A copy of that letter is attached hereto as EXHIBIT 3, and a copy of the return receipt from the Post Office is attached hereto as EXHIBIT 4. I attached to the letter all of the documents that were filed at the

PTO (a copy of all of these PTO documents could be provided herewith, if needed). The letter clearly stated that returning the documents to me without signing the Reissue Declarations would evidence Mr. Alexson's refusal to sign the Reissue Declarations. Mr. Alexson returned the documents to me unsigned via Federal Express on December 18, 2001, thereby evidencing his written refusal to sign the Reissue Declarations. A copy of the FedEx USA Airbill is attached hereto as EXHIBIT 5.

4c3) I contacted Mr. Robert Sprague, the 3M attorney representing the two inventors currently employed by 3M (Mr. James F. Pitzen and Mr. Jeffrey D. Smith), on or about December 13, 2001. I informed Mr. Sprague that I would be forwarding a copy of the Reissue Declarations and accompanying documents to his address at 3M, and I suggested to him that, if he did not wish to allow the inventors to sign the Reissue Declarations, then he should refuse delivery, or forward the package back to me with the Reissue Declarations unexecuted. I forwarded via registered mail a letter to Mr. Robert Sprague on December 17, 2001. A copy of that letter is attached hereto as EXHIBIT 6, and a copy of the return receipt from the Post Office is attached hereto as EXHIBIT 7. I attached to the letter all of the documents that were filed at the PTO (a copy of all of these PTO documents could be provided herewith, if needed). The letter clearly stated that returning the documents to me without signing the Reissue Declarations would evidence the inventors' refusal to sign the Reissue Declarations. Mr. Sprague returned the documents to me unsigned on January 2, 2002, thereby evidencing the written refusal of Mr. Pitzen and Mr. Smith to sign the Reissue Declarations. A copy of Mr. Sprague's letter to me dated January 2, 2001 is attached hereto as EXHIBIT 8.

- 5) I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1/4/01
Date

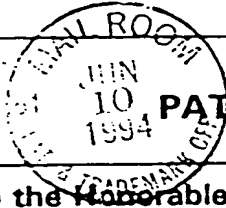


Patrick A. Doody
Registration No. 35,022

40.00-581

Jacket No. 50306USA6A

A/D



PATENT ASSIGNMENT RECORDATION COVER SHEET 09/258338

To the Honorable Commissioner of Patents and Trademarks:

Please record the attached original document or copy thereof.

1. Name of conveying party(ies):

James F. Pitzer, Jeffrey D. Smith
and Charles E. Alexson

Additional names of conveying party(ies) attached?

☐ Yes ☒ No

2. Name and address of receiving party(ies)

Minnesota Mining and Manufacturing Company
P.O. Box 33427
St. Paul, Minnesota 55133-3427

3. Nature of conveyance: ☒ Assignment 19

Execution Date(s): June 10, 1994

4. Application number or patent number: 50306USA6A

☒ This document is being filed with a new patent application on June 10, 1994.

☐ This document is to be recorded against the following patent application or patent:

5. Name and address of party to whom correspondence concerning document should be mailed:

Jeffrey J. Hohenshell
Minnesota Mining and Manufacturing Company
Office of Intellectual Property Counsel
P.O. Box 33427
St. Paul, Minnesota 55133-3427

6. Total number of applications and patents involved:

1

7. Total fee (37 CFR 3.41) . . . \$40.00

☐ Previously submitted

☒ Enclosed

8. ☒ Please charge any additional fees or credit any overpayment to Deposit Account No. 13-3723.

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9. Statement and signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Jeffrey J. Hohenshell

Printed Name of Attorney

Signature

Date

10 Total number of pages including cover sheet, attachments, and document:

3

50306-6Arec

Mail documents to be recorded with required cover sheet information to:
Commissioner of Patents & Trademarks, Box Assignments, Washington, D.C. 20231

140 AW 06/27/94 09258338

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40.00 OK 50306USA6A

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ASSIGNMENT

Whereas we, James F. Pitzon, Jeffrey D. Smith and Charles E. Alexson, with residences and citizenships as indicated below; have made an invention in

ORTHOPEDIC SURGICAL DEVICE

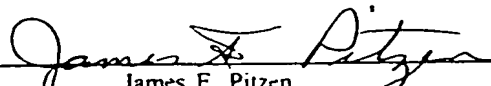
and have today executed an application for Letters Patent of the United States of America based thereon;

Now, therefore, for good and valuable consideration, receipt of which is acknowledged, we have individually and jointly agreed to assign and transfer and do hereby assign and transfer unto the MINNESOTA MINING AND MANUFACTURING COMPANY (sometimes designated as the Minnesota Mining & Manufacturing Company), a corporation of Delaware, having its principal office at Saint Paul, Minnesota, its successors and assigns, the entire right, title, and interest in and to the said invention and application, and in and to any division or continuation (in whole or in part) of said application, and in and to any and all improvements in the said invention made by us or any of us or made jointly with others (provided any such improvement is made during, or within one year after the termination of, the employment by the said Company of whichever of us, solely or jointly with one or more others, has made the same), and in and to any and all Letters Patent, reexaminations, reissues, or extensions thereof, of the United States of America and countries foreign thereto (including the right to apply for Letters Patent, Utility Models, or Inventors' Certificates in foreign countries in its own name and to claim any priority rights for such foreign applications to which such applications are entitled under international conventions, treaties, or otherwise), which have been or may be granted thereon or on any divisional, continuation (in whole or in part), renewal, reexamination, reissue, or other or further application based in whole or in part upon the said invention or improvements thereon, to be held and enjoyed as fully and exclusively as they would have been by us or any of us had this assignment and transfer not been made.

We do further agree for ourselves and for our heirs, executors, and administrators, to execute and deliver without further consideration any further applications, assignments, and documents, and to perform such other acts as we lawfully may, that may be deemed necessary by the said Company, its successors, assigns, and nominees, fully to secure its right, title, and interest as aforesaid and to obtain or maintain Letters Patent, Utility Models, or Inventors' Certificates in any and all countries;

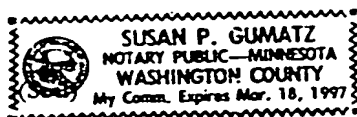
And we do hereby authorize and request the Commissioner of Patents to issue any and all Letters Patent which may be granted upon any of the said applications, to the said Minnesota Mining and Manufacturing Company, as the assignee of the entire right, title, and interest therein.

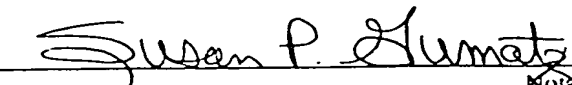
In witness whereof, we have hereunto signed our names on the day and year set forth below.


 James F. Pitzon
 Residence: City of Maplewood, County of Ramsey, State of Minnesota
 Citizenship: United States of America

STATE OF MINNESOTA }
 } ss.
 COUNTY OF RAMSEY }

On this 10th day of June 1994, before me personally appeared the above-named James F. Pitzon, known to me, and known by me to be the person described in and who executed the foregoing instrument, and who acknowledged that he executed the same as their free act and deed, on the day and year aforesaid.




 Susan P. Gumatz
 Notary Public

Jeffrey D. Smith

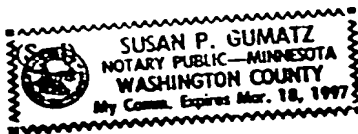
Jeffrey D. Smith

Residence: Marine on St. Croix, County of Washington, State of Minnesota

Citizenship: United States of America

STATE OF MINNESOTA }
COUNTY OF RAMSEY } ss.

On this 10th day of June 1994, before me personally appeared the above-named Jeffrey D. Smith, known to me, and known by me to be the person described in and who executed the foregoing instrument, and who acknowledged that he executed the same as their free act and deed, on the day and year aforesaid.



Susan P. Gumatz
Notary Public

Charles E. Alexson

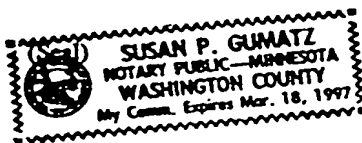
Charles E. Alexson

Residence: City of River Falls, County of Pierce, State of Wisconsin

Citizenship: United States of America

STATE OF MINNESOTA }
COUNTY OF RAMSEY } ss.

On this 10th day of June 1994, before me personally appeared the above-named Charles E. Alexson, known to me, and known by me to be the person described in and who executed the foregoing instrument, and who acknowledged that he executed the same as their free act and deed, on the day and year aforesaid.



Susan P. Gumatz
Notary Public

JUN 10 94

PATENT AND TRADEMARK
OFFICE

REEL 1042 FRAMES 61

ASSIGNMENT

MINNESOTA MINING AND MANUFACTURING COMPANY, a corporation of the State of Delaware, having a place of business at 3M Center, P. O. Box 33427, St. Paul, Minnesota 55133-3427 (hereinafter referred to as "3M"), may have right, title and interest (such as possibly record title) in certain patent rights and has agreed to transfer any interest it may have in such patent assets to LINVATEC CORPORATION, having a place of business at 11311 Concept Boulevard, Largo, Florida 33773 (hereinafter referred to as "LINVATEC") pursuant to and in accordance with the terms of an Asset Purchase Agreement between the parties dated June 29, 1999 (the "Asset Purchase Agreement").

Know All By These Presents that for and in consideration of good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, 3M has assigned and transferred, and by these presents does assign and transfer, to LINVATEC 3M's right, title and interest in and to the following United States Patents and Patent Applications:

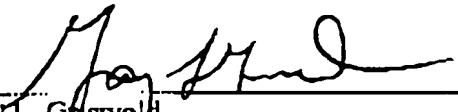
Patent No.	Issued
D-364,463	11/21/95
D-379,795	6/10/97
RE.33,362	10/2/90
4,386,609	6/7/83
4,414,967	11/15/83
4,500,025	2/19/85
4,527,726	8/6/91
4,540,110	9/10/85
4,569,469	2/11/86
4,648,541	3/10/87
4,728,876	3/1/88
4,736,742	4/12/88
4,819,334	4/11/89
4,834,092	5/30/89
4,872,452	10/10/89
4,901,712	2/20/90
5,080,983	1/14/92
5,540,374	7/30/96
5,553,675	9/10/96
5,575,054	11/19/96
5,697,158	12/16/97
5,792,573	8/11/98
Serial No.	Filed
08/693,917	8/5/96
08/723,800	9/30/96

and in accordance with and to the extent set forth in the Asset Purchase Agreement, continuations, continuations-in-part, divisions and patents issuing thereon, reexaminations, reissues and extensions of any such patents, , including 3M's rights of priority resulting from the filing of the applications on which the said United States patents have issued.

This assignment includes all of the patents and patent applications listed on the attached Schedule 1.04 which includes all of the aforementioned U.S. Patents and patent applications..

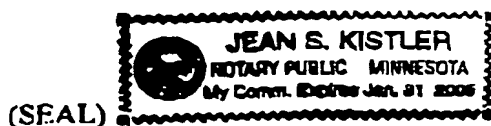
IN WITNESS WHEREOF, 3M has caused these presents to be signed by its Staff VP and Chief IP Counsel thereto duly authorized this 19th day of September, 2000

MINNESOTA MINING AND MANUFACTURING COMPANY

By 
Gary L. Griswold
Staff Vice President and
Chief Intellectual Property Counsel

State of Minnesota)
County of Ramsey) ss:

On this 19th day of September, 2000 before me personally appeared Gary L. Griswold to me personally known, who, being by me duly sworn, did say that he/she is Staff VP and Chief IP Counsel of Minnesota Mining and Manufacturing Company, that said instrument was signed on behalf of said corporation by authority of its Board of Directors, and he/she acknowledged said instrument to be the free act and deed of said corporation.




Notary Public



1751 PINNACLE DRIVE
SUITE 1700
MCLEAN, VIRGINIA 22102

TEL 703 • 714 • 7400
FAX 703 • 714 • 7410

PATRICK A. DOODY
DIRECT DIAL: 703-714-7645
EMAIL: pdoddy@hunton.com

December 14, 2001

FILE NO: 54525.000055

VIA Registered Mail

Mr. Charles E. Alexson
12651 W. Twin Lake Road
Hayward, WI 54843

Re: Reissue Declaration for Reissue of U.S. Patent No. 5,792,573
Our Reference No. 54525.000055

Dear Mr. Alexson:

I am enclosing for your signature a copy of a Reissue Declaration for the above-captioned patent, naming you as one of the inventors. The Reissue Declaration is accompanied by all of the documents that we filed at the United States Patent and Trademark Office when we filed the reissue application. These documents include: (i) a Reissue application including Specification, Claims, Abstract, and a copy of the drawings; (ii) a Preliminary amendment adding broader claims 13-35; (iii) an Original Reissue Declaration filed in parent application Serial No. 09/637,339; (iv) a Certificate under 37 C.F.R. §3.73(b) and Consent of Assignee; (v) a Request for Transfer of Drawings from Original Patent to Reissue Application with attached drawings; and (vi) an Offer to Surrender Pursuant to 37 C.F.R. § 1.178.

Returning this package and its contents without signing the Reissue Declaration or the Original Reissue Declaration will constitute your refusal to sign.

With best regards

Patrick A. Doody

PAD
Encl

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Charles E. Alexson
12651 W. Twin Lake Road
Hayward, WI 54843

Atty Dkt. No 54525.55

2. Article Number (Copy from service label)

EK713541817US

COMPLETE THIS SECTION ON DELIVERY

A. Received by (Please Print Clearly)

B. Date of Delivery

12-17-01

C. Signature

X

Lat Alexson

☐ Agent☐ Addressee

D. Is delivery address different from item 1?

☐ Yes

If YES, enter delivery address below:

☐ No

3. Service Type

☐ Certified Mail☒ Express Mail☐ Registered☐ Return Receipt for Merchandise☐ Insured Mail☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

PS Form 3811, July 1999

Domestic Return Receipt

102595-00-M-0952

UNITED STATES POSTAL SERVICE

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First-Class Mail
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• Sender: Please print your name, address, and ZIP+4 in this box •

Patrick A. Doody, Esq.
Hunton & Williams
1751 Pinnacle Dr., Ste. 1700
McLean, VA 22102

2102+3836

Express

Customer: Seal only when us

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2041732172 REV 1008

FedEx

STANDARD OVERNIGHT

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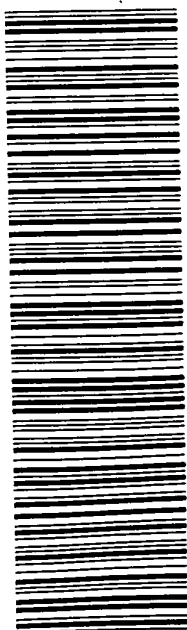
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22102 -U-R-US

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document.

FedEx USA Airbill
Express

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Form 10 No.

FedEx Retrieval Copy

1 From

Date 12/18/01

Sender's FedEx Account Number

Sender's Name CHARLES ALEXSON

Phone 715 462-9065

Company

Address 12651 W TURN LKS. RD.

City HARWARD

State WI ZIP 54843

2 Your Internal Billing Reference

3 To

Recipient's Name PATRICK DOODY

Phone 703 714-7400

Company HUTTON & WILLIAMS

Address 1751 PINNACLE DRIVE

Suite 1700

City MCLEAN

State VA ZIP 22102



4a Express Package Service

1 ☐ FedEx Priority Overnight 5 ☒ FedEx Standard Overnight 6 ☐ FedEx First Overnight

2 ☐ FedEx 2Day 20 ☐ FedEx Express Saver 77 ☐ NEW FedEx Extra Hours

3 ☐ FedEx 1Day Freight* 8 ☐ FedEx 2Day Freight 83 ☐ FedEx 3Day Freight

4b Express Freight Service

5 ☐ Packaging 2 ☒ FedEx Pak* 1 ☐ Other Pkg

6 ☐ Special Handling

7 ☐ Payment Bill To: Enter FedEx Acct. No. or Credit Card No. below.

8 ☐ Release Signature



1751 PINNACLE DRIVE
SUITE 1700
MCLEAN, VIRGINIA 22102

TEL 703 • 714 • 7400
FAX 703 • 714 • 7410

PATRICK A. DOODY
DIRECT DIAL: 703-714-7645
EMAIL: pdoody@hunton.com

December 17, 2001

FILE NO: 54525.000055

**VIA REGISTERED MAIL
RETURN RECEIPT REQUESTED**

ET 430837408 US

Mr. Robert Sprague
Minnesota Mining and Manufacturing Company
Office Of Intellectual Property Counsel
P.O. Box 33427
St. Paul, MN 55133

Re: Reissue Application Based on U.S. Patent No. 5,792,573
Our Reference No.: 54525.000055

Dear Bob:

We are enclosing a copy of a Reissue Declaration for the above-captioned patent. The patent names two current employees of 3M, Mr. James F. Pitzen, and Mr. Jeffrey D. Smith. You have previously informed us that you represent these two individuals in your capacity as Intellectual Property Counsel for 3M. We kindly ask that you forward the enclosed Reissue Declaration and associated papers to these inventors for their signature.

The Reissue Declaration is accompanied by all of the documents that we filed at the United States Patent and Trademark Office when we filed the reissue application. These documents include: (i) a Reissue application including Specification, Claims, Abstract, and a copy of the drawings; (ii) a Preliminary amendment adding broader claims 13-35; (iii) an Original Reissue Declaration filed in parent application Serial No. 09/637,339; (iv) a Certificate under 37 C.F.R. §3.73(b) and Consent of Assignee; (v) a Request for Transfer of Drawings from Original Patent to Reissue Application with attached drawings; and (vi) an Offer to Surrender Pursuant to 37 C.F.R. § 1.178.

Returning this package and its contents without signing the Reissue Declaration or the Original Reissue Declaration will constitute the above-named inventors' refusal to sign.



Mr. Robert Sprague
December 17, 2001
Page 2

We look forward to receiving the executed documents or returned package in due course.

With best regards,

A handwritten signature in dark ink, appearing to read 'P. Doody', written over the typed name.

Patrick A. Doody

PAD

Encl.

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Robert Sprague
Minnesota Mining and Manf. Co.
Office of Intellectual
Property Counsel
P.O. Box 33427
St. Paul, MN 55133

Phone: 651-733-4247

2. Article Number (Copy from service label)

ET430837408US

PS Form 3811, July 1999

COMPLETE THIS SECTION ON DELIVERY

A. Received by (Please Print Clearly) B. Date of Delivery

C. Signature

X

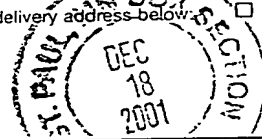
Kevin Ray

☐ Agent

☐ Addressee

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

X



3. Service Type

☐ Certified Mail

☒ Express Mail

☐ Registered

☐ Return Receipt for Merchandise

☐ Insured Mail

☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

UNITED STATES POSTAL SERVICE



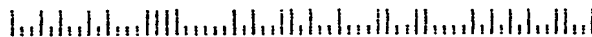
First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

Patrick A. Doody, Esq.
Hunton & Williams
1751 Pinnacle Dr., Ste. 1700
McLean, VA 22102

Atty Dkt No 54525.000055

06



Robert W. Sprague
Assistant Chief Intellectual
Property Counsel

Office of Intellectual
Property Counsel

3M Innovative Properties Company
3M Center
PO Box 33427
St. Paul, MN 55133-3427 USA
651 733 4247
651 736 3833 Fax
rwsprague2@mmm.com



January 2, 2002

VIA FEDERAL EXPRESS

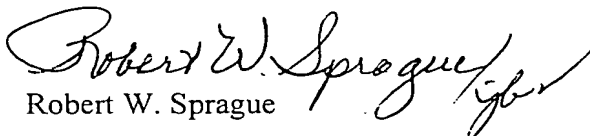
Patrick A. Doody, Esq.
Hunton & Williams
1751 Pinnacle Drive
Suite 1700
McLean, Virginia 22102

Re: Reissue Application Based on U.S. Patent No. 5,792,573
Your Ref. No.: 54525.000055

Dear Patrick:

As requested, enclosed please find the unsigned reissue papers that you sent me.

Very truly yours,

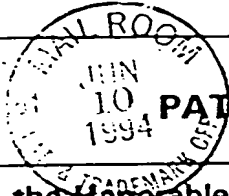

Robert W. Sprague

RWS/jlb
Enclosures

40.00-581

Jacket No. 50306USA6A

A/D



PATENT ASSIGNMENT RECORDATION COVER SHEET 88/258338

To the Honorable Commissioner of Patents and Trademarks:

Please record the attached original document or copy thereof.

1. Name of conveying party(ies):

James F. Pitzen, Jeffrey D. Smith
and Charles E. Alexson

Additional names of conveying party(ies) attached?

☐ Yes ☒ No

2. Name and address of receiving party(ies)

Minnesota Mining and Manufacturing Company
P.O. Box 33427
St. Paul, Minnesota 55133-34273. Nature of conveyance: ☒ Assignment 19

Execution Date(s): June 10, 1994

4. Application number or patent number: 50306USA6A

☒ This document is being filed with a new patent application on June 10, 1994.☐ This document is to be recorded against the following patent application or patent:

5. Name and address of party to whom correspondence concerning document should be mailed:

Jeffrey J. Hohenshell
Minnesota Mining and Manufacturing Company
Office of Intellectual Property Counsel
P.O. Box 33427
St. Paul, Minnesota 55133-3427

6. Total number of applications and patents involved:

1

7. Total fee (37 CFR 3.41) \$40.00

☐ Previously submitted☒ Enclosed8. ☒ Please charge any additional fees or credit any overpayment to Deposit Account No. 13-3723.

DO NOT USE THIS SPACE

9. Statement and signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Jeffrey J. Hohenshell

Printed Name of Attorney

Signature

Date

10 Total number of pages including cover sheet, attachments, and document:

3

50306-6A-100

Mail documents to be recorded with required cover sheet information to:
Commissioner of Patents & Trademarks, Box Assignments, Washington, D.C. 20231

93555215

140 PW 06/27/94 09258338

1 581

40.00 CK 50306USA6A

ASSIGNMENT

Whereas we, James F. Pitzen, Jeffrey D. Smith and Charles E. Alexson, with residences and citizenships as indicated below; have made an invention in

ORTHOPEDIC SURGICAL DEVICE


and have today executed an application for Letters Patent of the United States of America based thereon;

Now, therefore, for good and valuable consideration, receipt of which is acknowledged, we have individually and jointly agreed to assign and transfer and do hereby assign and transfer unto the MINNESOTA MINING AND MANUFACTURING COMPANY (sometimes designated as the Minnesota Mining & Manufacturing Company), a corporation of Delaware, having its principal office at Saint Paul, Minnesota, its successors and assigns, the entire right, title, and interest in and to the said invention and application, and in and to any division or continuation (in whole or in part) of said application, and in and to any and all improvements in the said invention made by us or any of us or made jointly with others (provided any such improvement is made during, or within one year after the termination of, the employment by the said Company of whichever of us, solely or jointly with one or more others, has made the same), and in and to any and all Letters Patent, reexaminations, reissues, or extensions thereof, of the United States of America and countries foreign thereto (including the right to apply for Letters Patent, Utility Models, or Inventors' Certificates in foreign countries in its own name and to claim any priority rights for such foreign applications to which such applications are entitled under international conventions, treaties, or otherwise), which have been or may be granted thereon or on any divisional, continuation (in whole or in part), renewal, reexamination, reissue, or other or further application based in whole or in part upon the said invention or improvements thereon, to be held and enjoyed as fully and exclusively as they would have been by us or any of us had this assignment and transfer not been made.

We do further agree for ourselves and for our heirs, executors, and administrators, to execute and deliver without further consideration any further applications, assignments, and documents, and to perform such other acts as we lawfully may, that may be deemed necessary by the said Company, its successors, assigns, and nominees, fully to secure its right, title, and interest as aforesaid and to obtain or maintain Letters Patent, Utility Models, or Inventors' Certificates in any and all countries;

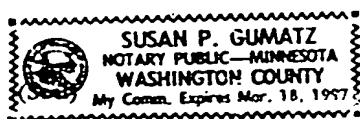
And we do hereby authorize and request the Commissioner of Patents to issue any and all Letters Patent which may be granted upon any of the said applications, to the said Minnesota Mining and Manufacturing Company, as the assignee of the entire right, title, and interest therein.

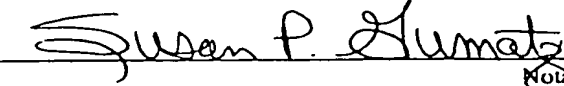
In witness whereof, we have hereunto signed our names on the day and year set forth below.


 James F. Pitzen
 Residence: City of Maplewood, County of Ramsey, State of Minnesota
 Citizenship: United States of America

STATE OF MINNESOTA }
 } ss.
 COUNTY OF RAMSEY }

On this 10th day of June 1994, before me personally appeared the above-named James F. Pitzen, known to me, and known by me to be the person described in and who executed the foregoing instrument, and who acknowledged that he executed the same as their free act and deed, on the day and year aforesaid.




 Susan P. Gumatz
 Notary Public

Jeffrey D. Smith

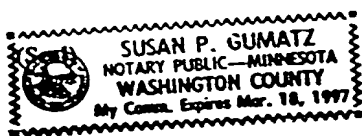
Jeffrey D. Smith

Residence: Marine on St. Croix, County of Washington, State of Minnesota

Citizenship: United States of America

STATE OF MINNESOTA }
COUNTY OF RAMSEY } ss.

On this 10th day of June 1994, before me personally appeared the above-named Jeffrey D. Smith, known to me, and known by me to be the person described in and who executed the foregoing instrument, and who acknowledged that he executed the same as their free act and deed, on the day and year aforesaid.



Susan P. Gumatz

Notary Public

Charles E. Alexson

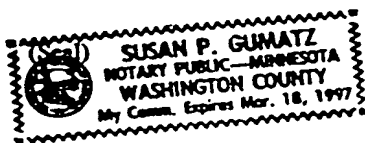
Charles E. Alexson

Residence: City of River Falls, County of Pierce, State of Wisconsin

Citizenship: United States of America

STATE OF MINNESOTA }
COUNTY OF RAMSEY } ss.

On this 10th day of June 1994, before me personally appeared the above-named Charles E. Alexson, known to me, and known by me to be the person described in and who executed the foregoing instrument, and who acknowledged that he executed the same as their free act and deed, on the day and year aforesaid.



Susan P. Gumatz

Notary Public

JUN 10 94

PATENT AND TRADEMARK
OFFICE

ASSIGNMENT

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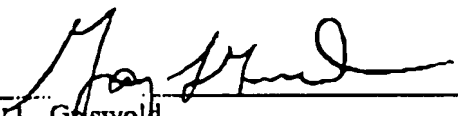
Patent No.	Issued
D-364,463	11/21/95
D-379,795	6/10/97
RE.33,362	10/2/90
4,386,609	6/7/83
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4,736,742	4/12/88
4,819,334	4/11/89
4,834,092	5/30/89
4,872,452	10/10/89
4,901,712	2/20/90
5,080,983	1/14/92
5,540,374	7/30/96
5,553,675	9/10/96
5,575,054	11/19/96
5,697,158	12/16/97
5,792,573	8/11/98
Serial No.	Filed
08/693,917	8/5/96
08/723,800	9/30/96

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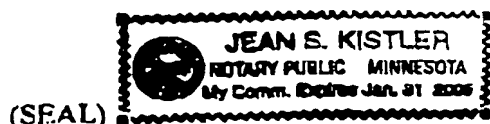
IN WITNESS WHEREOF, 3M has caused these presents to be signed by its Staff VP and Chief IP Counsel thereto duly authorized this 19th day of September, 2000

MINNESOTA MINING AND MANUFACTURING COMPANY

By 
Gary L. Griswold
Staff Vice President and
Chief Intellectual Property Counsel

State of Minnesota)
County of Ramsey) ss:

On this 19th day of September, 2000 before me personally appeared Gary L. Griswold to me personally known, who, being by me duly sworn, did say that he/she is Staff VP and Chief IP Counsel of Minnesota Mining and Manufacturing Company, that said instrument was signed on behalf of said corporation by authority of its Board of Directors, and he/she acknowledged said instrument to be the free act and deed of said corporation.




Notary Public